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GAS ABSTRACTS

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O. P. BRYSCH, Editor

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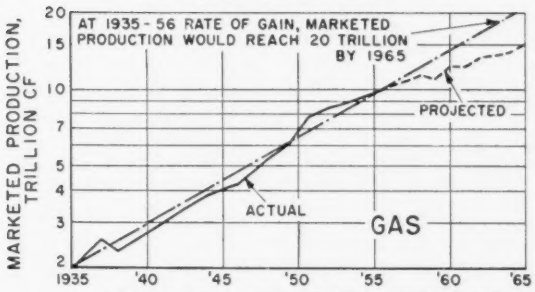
1. GAS INDUSTRY



(*Adapted from* OIL LOOKS AHEAD, *below*)

OIL LOOKS AHEAD. *Oil Gas J. 55,* 135-42 (1957) November 11.

A forecast of trends through '65, based largely upon the projections of Terry and Winger (*Gas Abstracts, 13,* 181), predicts continued gains in gas demand because population is growing. However, the phenomenal growth of the gas industry during the past two decades was due largely to replacement of other fuels by gas, a trend which is slowing today and will result in a slower rate of gain in the predictable future (*see graph above*).

Energy Sources

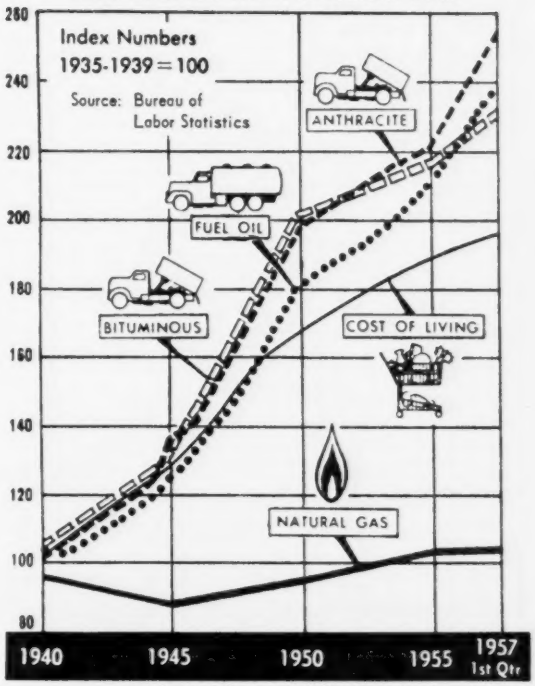
Burnett, E. OIL AND NATURAL GAS: THE MAGNITUDE OF THE INDUSTRY. *Computers & Automation 6,* 15-18 (1957) Nov.

A statistical review of the oil and gas industry. Petroleum now provides over 40% of the total energy used in the U. S. with natural gas accounting for 25%. The four major segments of the industry, production, refining, transportation, and marketing are discussed. The appendix includes the position of the top companies in the field and the future growth expected by oil men.

Eltham, E. SUEZ CRISIS SPURS HUNT FOR NEW ENERGY SOURCES. *World Petrol. 28,* 89, 92-94 (1957) November.

After a description of the resources of conventional forms of energy, coal, oil and hydroelectric power, some of the proposals for new sources of energy are discussed. European countries have increased plans for greater use of atomic energy. England has visualized an atomic power demand nearly equal to oil by 1975. By 1965, the U. S. plans 24 plants to use atomic energy equaling 27 million bbl of oil.

COST OF LIVING AND PRICES OF OTHER FUELS HAVE RISEN FASTER THAN NATURAL GAS



(*Adapted from* LAMBERT, D. E., *below*)

Lambert, D. E. FEDERAL CONTROL OF NATURAL GAS. *Pipe Line Ind. 7,* Supplement (1957) November; *World Oil 145,* Supplement (1957) November.

Eight-page pamphlet, printed and sold separate from the magazines for wider distribution, summarizes and graphically illustrates arguments against federal control of producers, and points out that without such control gas prices have increased less than other fuel prices or cost of living (*see graph above*).

Basic Research

Waterman, A. T. BASIC RESEARCH. A NATIONAL RESOURCE. Nat. Science Foundation Report NSF 57-35, Washington: G.P.O. (1957).

A timely discussion of basic research as the "defense in depth" for our whole technology, using data from the NSF survey of 1953-54 to illustrate the current situation and the need for extended effort. Various institutions spent $5.4 billion on research and development in physical

and life sciences, of which 8% or $435 million was for basic research. Since 1947 progress has been made but basic research and training of its personnel are still underemphasized. Incentives which insure the future of applied research do not have direct impact on basic research. Redoubled efforts are required to keep pace with demands of technology.

Engineer Shortage

Fremed, R. F. STRAIGHT FACTS ON THE 1958 JOB OUTLOOK. *Chem. Eng. 64,* 479-82 (1957) Inventory Issue.

Opposite stands have been taken on the engineering shortage. A book by Bland & Stigler calls the shortage an economic myth that never existed in the past and will not exist in the future. A study made by Deutsch & Shea, however, says that companies will continue to find stiff competition in the market for engineering graduates. After a discussion of pros and cons, the article concludes that there is and always will be a shortage of good men.

Northwest Gas

Gueffroy, C. H. GASCO PRESIDENT REVIEWS NORTHWEST'S FIRST YEAR OF NATURAL GAS. *Gas Age 120,* 18, 19 (1957) November 28.

Northwest distributors have added 40,000 space heating customers, increased sales 600% and laid the foundation for doubling the total of industrial customers since the advent of natural gas, although many of the utilities still have several months to go before completing a full year of service. Westcoast Transmission Co. Ltd. will pipe gas from Canada, joining the present supply from the Pacific Northwest Pipeline.

Trexel, C. A., Jr. IMPACT OF NATURAL GAS ON THE ECONOMY OF THE PACIFIC NORTHWEST. *Chem. Eng. Progress 53,* 130-32, 34 (1957) November.

The use of natural gas will strengthen the total energy supply position on which industrial development and diversification depend, and will help to eliminate intermittent gaps that have occurred in the past, for example, when water was not available and electricity was curtailed. The industrial market for natural gas is expected to account for roughly 55-60% of total utility sales by distribution companies.

Oil Imports

Carson, M. V. Jr. REMARKS ON IMPORTS. COOPERATION AND COORDINATION. *Indep. Petrol. Assoc. Amer. Monthly 27,* 17, 18, 67, 68 (1957) November.

The U. S. government cannot allow the health of its domestic petroleum industry to be undermined or to be too heavily dependent upon foreign sources. Security requires a reasonable balance between imports and domestic production. Mandatory controls and tariff are not the answer. Crude oil imports for the last half of 1957 had been scheduled at 970,000 bbl per day. As a result of voluntary and cooperative efforts, imports in September were 782,000 bbl per day. Unfortunately, four of the importing companies do not adhere to the import allowables.

2. APPLIANCES, DOMESTIC

Air Conditioning

Berry, N. E. (assigned to Arkla Air Conditioning Corp.) AIR CONDITIONING. U. S. 2,814,-468 (1957) November 26.

A heating and cooling system where the pressure drop, on the heating cycle, between the generator and evaporator, is materially reduced permitting the generator to be operated at much lower temperatures than formerly.

NINE-BUILDING COUNTY CIVIC CENTER TO BE YEAR-ROUND CONDITIONED. *Gas Age 120,* 11-14, 50 (1957) November 28.

Gas-fired equipment with oil standby forms core of a system which will produce 120,000 lbs of steam/hr for $4.5 million central heating-refrigeration plant.

Burners

Ayers, W. P. GAS BURNER. U. S. 2,808,878 (1957) October 8.

A ceramic radiant burner is claimed, comprising spaced parallel burner ports fed by a plenum-type boxing, with positive pilot ignition.

Lowe, F. J. Jr. PROPER CONNECTION TO THE CHIMNEY AND APPROVED PIPING REQUIRED TO FINISH THE JOB. *Gas Heat and Comfort Cooling 8,* 34, 35 (1957) Nov.

Manufacturers' instructions for the installation of their conversion gas burners, and the provisions of local codes put a limit on the installer's individual methods. Suggestions are presented which are not always covered in other instructions, such as piping the burner and the calculation and installation of flue pipe.

Ryden, E. H. (assigned to Scaife Co.) GASEOUS FUEL BURNER. U. S. 2,814,338 (1957) November 26.

An improved single-port gas burner is claimed in which blowoff of flame is minimized by deflection plates in the burner head which retard flow of a portion of the combustion mixture through outer concentric channels.

Refrigeration

Guise, A. B. and Krause, W. O. A SIMPLE MOISTURE INDICATING DEVICE FOR REFRIGERATING SYSTEMS. *Refrig. Eng. 65,* 39-44 (1957) December.

Continuous visual indication is obtained as to whether a refrigerating system is operating within safe moisture limits without the necessity for sampling followed by laboratory determinations or the use of specialized equipment.

Solar Heating

Bridgers, F. H., Paxton, D. D. and Haines, R. W. PERFORMANCE OF A SOLAR HEATED OFFICE BUILDING *Heatg. Pipg. and Air Condg. 29,* 165-70 (1957) November.

The first solar heated office building, located in Albuquerque, New Mexico, has been operating successfully during the 1956-57 heating season. A 6,000-gal insulated underground water storage tank is used to store collected solar heat for cloudy weather and nighttime use. A 7-1/2 ton package water chiller is used as a heat pump in winter and for cooling the building in summer. A summary of the heat operation is presented.

Nevins, R. G. and McNall, P. E. Jr. A HIGH-FLUX LOW-TEMPERATURE SOLAR COLLECTOR. *Heatg. Pipg. and Air Condg. 29,* 171-76 (1957) November.

Solar collection efficiencies of 65-75% were obtained on clear days during the summer of 1956 with a focusing low-temperature solar collector. Solar energy was collected at a rate of 3700-4200 Btu per hr at collector temperatures of 100°-170°F. Efficiencies on cloudy days varied from 40-60%. Theoretical analysis is presented to show the effect of the concentrating power on the collection efficiency. A discussion of a "black body cover" to increase the effective absorptivity of the collector is presented.

Threlkeld, J. L. and Jordan, R. C. DIRECT SOLAR RADIATION AVAILABLE ON CLEAR DAYS. *Heatg. Pipg. & Air Condg. 29,* 135-45 (1957) December.

The results of research on the incidence of direct solar radiation during clear days in the U. S. A fundamental procedure for determining atmospheric transmission factors for various atmospheric conditions and elevations. A more approximate procedure involving the concept of a basic atmosphere together with atmospheric clearness numbers. Correlations with observed solar radiation at several localities.

Space Heating

Johnson, L. H. ZONE TEMPERATURE CONTROL. WHAT A SERVICEMAN SHOULD KNOW ABOUT IT. Part 1. *Gas 33,* 89-92 (1957) October; Part 2. *Ibid.* 54-59 November; Part 3. *Ibid.* 43-49 December.

The function of zone controls used, with a discussion of control devices specially designed to operate in conjunction with other controls in the zone system. A list of the steps taken by a utilities serviceman in servicing a system equipped with zone control.

Wills, D. R. and Chance, P. A. A COMPARISON OF HEATING SYSTEMS IN TWO OCCUPIED HOUSES. Research Comm. GC 42. London: The Gas Council, November 1957. *Gas World* (British) *146,* 968-70 (1957) Nov. 23.

Basic data using various combinations of appliances and heating systems. Evaluations are made of warm-air ceiling panels and convection heating. Different levels of background heating ranging from a low value to higher levels associated with whole-house heating. All-gas systems were replaced by coke open fires to enable a comparison between the all-gas and the more conventional solid-fuel systems.

GAS HEATS HUGE U.S. SHOPPING CENTER BUILT ON HISTORIC ROOSEVELT FIELD. *Gas J.* (British) *292,* 342, 43 (1957) November 13.

The shopping center, comprising nine one-story and one two-story structures all devoted to retail selling, has 110 stores of 1.3 million sq ft of sales floor. Steam heat is used in the buildings, supplied from 34 gas-fired boilers. The largest is rated by the engineers and producers, Bryant Manufacturing Co., at just under 4,000,000 Btu/hr.

SELECTIVE AIR HEATING FOR DOMESTIC USE. *Gas J.* (British) *292*, 192-94 (1957) October 23.

Gas-fired fanned-air heaters installed centrally but with short ducts to and louvres in various rooms enable the warm air to be directed as desired without heating the whole house. The South Eastern Gas Board has done pioneer work with builders and appliance makers in developing this "selective" low cost air heating system for use in modern dwellings.

Water Heating

Cameron, D. L. COMBINED WATER HEATER AND STORAGE TANK. U. S. 2,814,278 (1957) November 26.

An annular, cylindrical heating and storage tank for water. The annulus is flared at the base and extends up through the shell as a flue. A petticoat pipe concentrically surrounds the major portion of the flue inside the water space. It is flared and welded to form a prompt-delivery hot water chamber, with cold-water inlets through the lower petticoat shell and hot water egress through the open annular space into the upper tank.

Thomas, M. A. (assigned one-third to Wayland D. Keith) DUAL WATER HEATING SYSTEMS. U. S. 2,814,279 (1957) November 26.

A water heating system which will maintain two different temperatures for withdrawal is controlled by a single thermostat which turns on the gas almost simultaneously upon the withdrawal of the hot water. An outgoing coil within the flue of the system further heats the normal hot water, making it possible for different temperatures to be obtained from a single tank. Fuel ignition is accelerated by a thermocontrol valve which provides direct cold water for the thermostat.

3. COMBUSTION AND INDUSTRIAL FURNACES

Air Pollution

Crumley, P. H. and Fletcher, A. W. THE EMISSION OF SULFUR GASES FROM A DOMESTIC SOLID-FUEL APPLIANCE. *J. Inst. Fuel* (British) *30*, 608-12 (1957) November.

Determinations have been made on the concentration of total sulfur compounds in the flue gases from a domestic openable stove during various stages of the combustion of coal and coke. Separate determinations were made of the concentration of H_2S, SO_3, and NO_2 and the normal constituents of the flue gases (CO_2, CO, H_2 and CH_4).

Cummings, W. G. and Redfearn, M. W. INSTRUMENTS FOR MEASURING SMALL QUANTITIES OF SULFUR DIOXIDE IN THE ATMOSPHERE. *J. Inst. Fuel* (British) *30*, 628-35 (1957) November.

An automatic recorder and a portable meter have been developed for measuring small quantities of SO_2 in the air. Designed especially for atmospheric pollution work, both instruments are sensitive to one part of SO_2 in 100 million parts of air. Field trials have proved their reliability.

Hemeon, W. C. L. TRENDS IN AIR POLLUTION. *Ind. Heating 24*, 2320, 22, 24, 26 (1957) November.

Developments of the past four or five years in the field of air pollution, with some special emphasis on aspects of particular interest to the steel industry. Governmental activity and research done on the Los Angeles smog problem are discussed.

Lucas, D. H. CERTAIN ASPECTS OF THE DEPOSITION OF DUST. *J. Inst. Fuel* (British) *30*, 623-27 (1957) November.

The practice and theory of the measurement of deposition have been considered. Experiments have been carried out which show that a deposit gauge at ground level collects far more dust than a gauge four ft above the ground. It is concluded that much of this additional catch is dust re-entrained from the ground and is "spurious deposition." Experiments have also shown that a standard gauge catches twice as much dust when its bowl is kept wet as it does normally.

Whitby, K. T., Algren, A. B., Jordan, R. C. and Annis, J. C. THE ASHAE AIR-BORNE DUST SURVEY. *Heatg. Pipg. and Air Condg. 29*, 185-92 (1957) November.

The results of the first part of the Amer. Soc. of Heating and Air Condg. Eng. dust survey, which had as its principal objective the determination of airborne dust properties that have an effect on the performance of air cleaners. Properties determined were: concentration of fibrous and fine particles, stain concentration, particle size distribution, particle density, porosity of packed sediment and dust fall.

Explosion Safety

Brandt, R. and Growe, B. SICHERUNGS-EINRICHTUNGEN FUER MIT DRUECK-SAUERSTOFF UND DRUECKLUFT BE-TRIEBENE STADTGASANLAGEN SOWIE AUCH FUER GASVERDICHTERANLAGEN (SAFETY DEVICES FOR CITY GAS PLANTS AS WELL AS GAS COMPRESSOR PLANTS OPERATING WITH COMPRESS-ED OXYGEN AND AIR). *Gas-u. Wasserfach* (German) *98*, 1129-32 (1957) November 8.

A back-flash safety device is proposed as a replacement of the usual water-seals in high-pressure gas lines. Because of possibilities of leakage and of disadvantageous effects on the flame characteristics, the wet seal device is considered as almost useless. The new diaphragm-type unit operates on a dry basis and resists a creeping, as well as a shocking back-flash.

G. Matus

Exhaust Cleanup

Houdry, E. J. (assigned to Oxy-Catalyst, Inc.) CATALYTIC EXHAUST GAS CONVERTER. U.S. 2,811,425 (1957) October 29.

Oxidation of burnable compounds in the exhaust gases of internal combustion engines is claimed for a catalytic oxidizer comprising sectional units of streamlined ceramic catalyst rods arranged in close-packed rows transverse to the flow of gases through an exhaust gas chamber.

Flame Radiation

Sherman, R. A. HEAT TRANSFER BY RADIATION FROM FLAMES. *Trans. Amer. Soc. Mech. Eng. 79*, 1727-42 (1957) November.

A unique example of international cooperation is research on radiation from flames conducted at the Royal Netherlands Blast Furnace and Steel Works. Support from the Netherlands, France, and Great Britain now has been joined by Belgium, Sweden, U. S. and the European Community of Coal and Steel. This paper outlines the organization of the work, experimental facilities, methods of research, and outstanding results on flame radiation. Variables have been the type of fuel oils or coke-oven gas, heat input, supply of atomizing agent, burner, excess of air, carbureting agent for gas, and the temperature of the combustion air. Of these, the C/H ratio of the oil and gas fuels and the mixing most affect emissivity and radiation.

Heat Treating

Kerlie, W. L. and Richards, J. H. ORIGIN AND ELIMINATION OF HYDROGEN IN BASIC OPEN-HEARTH STEELS. *J. Metals 9*, 1541-48 (1957) December.

The variation in hydrogen content of basic open-hearth steels during refining and the effect of changing from steam to air atomization. The water content of the furnace atmosphere, the slag basicity, and the degree of oxidation of the slag-metal system largely control the hydrogen in the steel.

Ocean, E. J. and Kiehle, C. B. CONTINUOUS STRIP ANNEALING OF STEEL. *Ind. Gas 36*, 5-7, 20 (1957) November.

Equipment used in high-speed strip annealing include one of the following furnace types: 1) roller hearth furnace, equipped with a direct or indirect heating system, cooling chambers, and fans for heating by forced convection; 2) tower furnace, consisting of one or more vertical heating chambers and one or more cooling chambers with supporting drums on top and bottom; and 3) catenary furnace, including rolls located outside the heating chamber support so that the strip of steel hangs in a catenary having contact with supports in the heating chamber. Methods of heat application using natural gas as fuel include recirculation, indirect firing, direct firing, full muffle, radiant tubes, and cup burners. Advantages over batch annealing methods are listed.

Peck, C. E. APPLICATIONS OF FURNACE ATMOSPHERES. Part 1. *Ind. Heating 24*, 2268-70, 72, 74, 76, 78, 80 (1957) November.

The identification of the important commercial atmospheres available for metal processing.

Petzold, A. and Betzer, M. PRETREATMENT OF SHEET STEEL FOR ENAMELLING. *Ceramics* (British) *9*, 38-41 (1957) October.

Bright annealing of sheet steel for enamelling is discussed. Experiments on its use as a method of pretreating sheet metal for application of white single-coat enamels directly to a steel.

DETROIT STEEL'S NEW FURNACE INSTALLATION FOR BRIGHT ANNEALING OF COLD ROLLED STRIP. *Ind. Heating 24*, 2313, 14, 16 (1957) November.

Natural gas serves the Portsmouth, Ohio plant

of Detroit Steel Co. both as a fuel and as a source of controlled atmospheres for its new furnaces. Four gas generators, each with a 6,000 CF/hr, provide deoxidizing atmosphere for all 18 furnaces. Total gas consumption averages 30,000 CF/hr.

Industrial Heating

Aubert, F. B. (assigned to Detroit Controls Corp.) TUNNEL-TYPE GAS BURNER AND DOUBLE IGNITION AND FLAME-SENSING PILOT MEANS. U. S. 2,814,339 (1957) November 26.

An improved tunnel burner, with good stability at higher fuel velocities, comprises a fuel-feed tube, with a pilot-light tube of conductive material mounted concentrically and electrically insulated from the burner, and an outer pilot tube mounted in the combustion cup so that the two pilot flames impinge. The central pilot stabilizes the flame at high air-fuel rates while the electrical conducting path through the two pilot flames gives a reliable control of fuel feed at low rates.

Lowe, J. A. WHY YOU SHOULD USE GAS-FIRED FURNACES. *Ind. Gas* (British) *21*, 12-16 (1957) November.

A description of gas furnaces used for process heating, metal melting, metal forming and billet heating systems. Infinite variations in use, plentiful supply and high quality of town gas are discussed.

Ventilation

APPROVE CHICAGO'S NEW VENTILATION CODE. *Heatg. Pipg. & Air Condg. 29*, 97-110 (1957) December.

The new Chicago ventilation code, revised for new developments and requirements for ventilation of commercial and industrial occupied spaces. Effective as of November 18, 1957, the code includes new provisions to eliminate unhealthy and hazardous conditions in industrial applications.

MOVIES SMOKE OUT VENTILATION PROBLEMS. *Chem. Week 81*, 45, 46 (1957) November 9.

A motion picture study of smoky air currents has been made at du Pont's Niagara Falls plant. By tracking the cloudy trails from smoke bombs released, the movies helped find the proper location of fresh-air intakes and height of exhaust stacks to prevent downwash recirculation of discharged air. The ventilation system developed, scheduled for partial use next summer, will cool by increasing the flows of fresh air going into, and exhaust air coming out of, operating areas.

4. GASIFICATION AND CARBONIZATION

Ammonia Recovery

van Ackeren, J. (assigned to Koppers Co., Inc.) APPARATUS FOR THE RECOVERY OF AMMONIA FROM COKE OVEN GAS. U.S. 2,811,424 (1957) October 29.

Apparatus for the concurrent absorption of a material from a gas and crystallization of the resulting product from the absorbent solution. Improvements are made in the spray-type ammonia saturators by an arrangement of a classification-type crystallizer, spray-type absorber, mist precipitators and vacuum evaporators into a unitary structure of economical design and high-operative efficiency.

British Coals

Wandless, A. M. BRITISH COAL SEAMS: A REVIEW OF THEIR PROPERTIES WITH SUGGESTIONS FOR RESEARCH. *J. Inst. Fuel* (British) *30*, 541-52 (1957) October.

The physical and mechanical properties of the seams from which British coal is currently produced. Trends are indicated and the following suggestions are made for future coal research: 1) physical and mechanical properties of coal seams in situ, 2) the use of small coal, 3) problems of coal rank, and 4) sulfur in coal.

Coal-Fired Turbine

Walter, L. GERMAN COAL-FIRED TURBINE IN OPERATION. *Coal Util. 11*, 39, 40 (1957) November.

Swiss experience and German engineering have produced the first closed-cycle industrial gas turbine plant in Germany. Selected because of consideration of partial load efficiency, the unit also produces heat for space warming without increased coal consumption.

Coal Swelling Index

Chalishazar, B. H. and Spooner, C. E. OXIDATION STUDIES ON COALS. Part 1. THE CRUCIBLE SWELLING TEST. *J. Inst. Fuel 30,* 520-23 (1957) September.

The effects of oxidation and size reduction on the swelling properties of six bright coals were examined. The oxidation was carried out in air at several different temperatures and the swelling properties were measured. It was found that the swelling index, which increased as the coal samples were more finely ground, was directly proportional to the specific surface area of the coal particles.

Gasification Reactions

Keslikh, V. E. and Sheshakov, N. V. GASIFICATION OF CARBON WITH STEAM IN THE PRESENCE OF CATALYSTS. *Gazovaya Prom.* (Russian), 7-11 (1957) No. 10.

Reaction rates were studied on a laboratory scale to determine effect of catalysts on the steam-carbon reaction at temperatures of 630°, 680° and 730°C. As a result of these tests, the authors recommend the use of K_2CO_3, $CuCl_2$ and $FeCl_2$. Introduction of catalyst in vapor state is preferred. Selective action of $CuCl_2$ can be used to maintain proper CO/H_2 ratio in synthesis gas production. Catalytic action would be more effective in fluidized bed generators because of lower operating temperatures. $CuCl_2$ is recommended to selectively increase CO content, and K_2CO_3, KOH, or $FeCl_3$ are recommended to selectively increase H_2 content.

J. W. Penney

Tschuchanow, S. F. DIE ROLLE DER KOHLENDIOXYD-REDUKTIONSREAKTION BEI DER KOKSVERBRENNUNG (THE ROLE OF THE CARBON DIOXIDE-REDUCTION REACTION IN THE COMBUSTION OF COKE). *Brennstoff-Chemie* (German) *38,* 289-97 (1957) October 16.

The intensity of the reaction CO_2-C is important in the combustion and gasification of solid fuels. It is difficult to determine the speed because the reaction is not isothermal and H_2, CO, and water vapor have some influence. The regions of this heterogenous reaction are divided into kinetic, transitional and diffusion. The limits of these are evaluated by using the Semyenov number. In furnaces and gas generators the reaction occurs in the kinetic region, and hydrodynamics has little influence. Fixing the reaction zone enables control of the reaction intensity. Theoretical calculations of gas formation during the reduction of CO_2 agree with experimental data.

G. Matus

Mine Methane Recovery

COLLIERY METHANE FOR GAS BOARDS. *Gas World* (British) *146,* 824, 25 (1957) November 2; *Gas J.* (British) *292,* 287, 88 (1957) November 6.

Methane is being extracted from local mine workings to be used instead of coal to provide a part of the ordinary gas supply for home and industry in the Stoke-on-Trent district. It is expected to save about 1,000 tons of coal a week. Successful use of methane from collieries for this purpose has been made in other British coalfields but this is the first scheme in the Midlands.

Naphthalene Recovery

Hartmann, L. T. (assigned to Allied Chemical & Dye Corp.) METHOD AND APPARATUS FOR TREATING COKE-OVEN GAS. U. S. 2,810,450 (1957) October 22.

Coke-oven gas cooling and recovery of naphthalene are claimed in a multi-stage process in which the gas is first partially cooled with water from final stage, then scrubbed with benzolized wash oil to remove naphthalene, then cooled to final temperature and scrubbed with lean wash oil in a separate tower.

Schmalenbach, A. (assigned to Koppers Co.) PROCESS FOR SEPARATING AROMATIC HYDROCARBONS FROM COAL DISTILLATION GASES. U. S. 2,809,717 (1957) October 15.

Naphthalene is removed from compressed coal distillation gases by scrubbing in a separate tower with decanted heavy aromatic oil condensate obtained by indirectly cooling the compressed gas to normal temperatures.

Oil Gas

Gattiker, M. DER SHELL OELVERGASUNGSPROZESS UND SEINE ANWENDUNG IN DER INDUSTRIE (THE SHELL OIL GASIFICATION PROCESS AND ITS APPLICATION IN INDUSTRY) *Erdol u. Kohle* (German) *10,* 581-84 (1957) September.

The Shell oil gasification process was developed

to make use of any petroleum fraction up to heavy asphalt oil. The process and the Ijmuiden plant (50 tons oil/day) are described, and the application of the process to the production of synthesis gas and city gas, as well as the hydrodesulfurization of oil fractions is outlined.

G. Matus

Gaucher, L. P. (assigned to The Texas Co.) BURNER FOR OIL-FIRED GAS GENERATOR. U. S. 2,810,433 (1957) October 22.

Apparatus for a burner assembly is claimed for use in a flow-type gas generator. A stream of hydrocarbons and a stream of oxygen are conveyed to the generator reaction zone with an elongated burner having a frusto-conical depression. An annual cooling channel supplies a coolant, such as water, in direct heat exchange relation to the hottest part.

Guillon, H. (assigned to Office Central de Chauffe Raionnelle, France) METHOD FOR THE GASIFICATION OF HEAVY FUEL OILS. U. S. 2,813,784 (1957) November 19.

Heavy oil is gasified by injecting it tangentially in multiple solid jetstreams, surrounded by a concentric air jet onto the refractory sole of an oven. The temperature is maintained at 1300°-1500°C, with the airstream reacting with both the volatile and the residual coked material.

Maloney, H. T. (assigned to The United Gas Improvement Co.) METHOD OF MAKING COMBUSTIBLE GAS. U. S. 2,813,012 (1957) November 12.

An improved cyclic catalytic method for gasification of fluid hydrocarbons. During the heating cycle a combustion of fluid fuel in a refractory chamber heats the Ni or Co catalyst bed. During the "make" cycle, hydrocarbon fuel is added to the products of combustion, with combustion continuing at a reduced rate.

McKean, J. B. THE PRODUCTION OF TOWN GAS BY THE CATALYTIC GASIFICATION OF PETROLEUM OILS. *Inst. Petrol. Rev.* (British) *11*, 90-97 (1957) April.

Catalyst development plant, design and operating results (with 950 sec viscosity heavy oil, 200 sec fuel oil, and gas oil) of the Sydenham works, first in England to employ the process. The catalyst is fine-ground magnesite and precipitated chalk, molded into 1-1/4 in. rings, air-dried, and fired at 1400°C.

Strasser, D. M., Guptill, F. E. and Marion, C. P. GASIFICATION OF LIQUID FUELS. U.S. 2,809,104 (1957) October 8.

Production of synthesis gas from steam, oxygen and hydrocarbon oils is improved by premixing of preheated steam and oil to a turbulent, intimate dispersion of liquid oil and injection at 50-500 psi and 300°-1000°F into a combustion zone at high velocity.

Organic Sulfur

Priestly, J. J. REDUCING THE SULFUR CONTENT OF TOWN GAS. Part 1. *Gas Times* (British) *41*, 640-43 (1957) October; Part 2. *Ibid.* 724, 33, 35, 37 November.

The final results including cost data obtained from the Holmes-Maxted pilot plant erected at Mirfield. The process involves the reaction of organic sulfur compounds with a suitable catalyst and some of the hydrogen normally present in town gas forming H_2S and carbon. Catalysts used are metallic thiomolybdates.

Oxide Box Reactions

Cope, F. H. THE INFLUENCE ON PURIFICATION PROCESSSES OF SOME MODERN DEVELOPMENTS IN THE GAS INDUSTRY. *Gas World* (British) *146*, 860-66 (1957) Nov. 9. *Gas J.* (British) *292*, 409-12, 15, 16 (1957) Nov. 20.

The estimation of H_2S in foul gas is very widely done by the oxidation reaction employing iodine, though the method allows some inaccuracy. Box performance factors are correlated with kinetics.

Reformed Gas

Barnes, J. M. and Bergey, E. S. CARRIER GAS PRODUCTION: EASTERN UTILITY INSTALLS CATALYTIC REFORMING UNITS. *Gas 33*, 39-42 (1957) December.

The Philadelphia Electric Co.'s carrier gas shift from coke oven gas to the hydrogen, carbon monoxide, and carbon dioxide of a new process went on unnoticed by its customers. The sendout gas is now comprised of 68.5% natural gas, 30.5% of the new reformed gas and 1% diluent air. Hydrocarbons react with steam over catalysts at elevated temperatures to produce the synthetic gas. The three units installed are designed to produce 16.5 MMCF/day when

reforming natural gas, and 12 MMCF/day when using propane as the hydrocarbon feedstock.

Faatz, A. C. Jr. (assigned to Foster Wheeler Corp.) PROCESS FOR PRODUCING GASES CONTAINING HYDROGEN FROM HYDROCARBONS. U. S. 2,813,779 (1957) November 19.

In a reforming process for producing hydrogen, unreacted hydrocarbons are converted by adding the endothermic heat by passage through a reheater and a second catalyst bed at 1400°-2000°F.

SO_2 Recovery

Johnstone, H. F. and West, W. E. Jr. RECOVERY OF SULFUR DIOXIDE FROM GASES AND PRODUCTION OF AMMONIUM SULFATE. U. S. 2,810,627 (1957) October 22.

Sulfur dioxide is recovered from waste gases resulting from the combustion of sulfur-containing coal or from roasting or sintering of sulful-containing materials. A solution of ammonium sulfite is produced by absorption of SO_2 in an ammoniacal solution. This solution is treated with sulfuric acid which reacts with ammonium sulfite to form ammonium sulfate and sulfur dioxide.

5. NATURAL GAS AND NATURAL GAS CONDENSATES

British Gas

NATURAL GAS FOR GAS BOARDS. *Gas World* (British) *146*, 824, 25 (1957) November 2; *Ibid.* 68, 69 November 9; *Gas J.* (British) *292*, 289 (1957) November 6.

The first supply of natural gas has gone into commercial use in Great Britain. The gas from a 1,600 ft well at Cousland (Scotland) is being mixed with coal gas and piped to consumers. The drilling has cost about 30,000 pounds. Another 25,000 pounds has been invested in the plant and pipeline. Estimates of the quantity of natural gas in the reserve have varied between 250 MMCF and 2,500 MMCF. At the present rate of consumption there is, on these estimates, enough gas to last between seven and 70 years.

Carbon Black

Ekholm, W. C. and Heller, G. L. (assigned to Columbian Carbon Co.) CARBON BLACK. U. S. 2,813,009 (1957) November 12.

An improved method of producing fine, rubber-reinforcing furnace blacks from liquid hydrocarbons whereby adequate dispersion of the normally liquid hydrocarbons is effected prior to carbon-forming decomposition or substantial partial combustion. The hydrocarbons are uniformly heated, vaporized, and partially pyrolyzed in a furnace chamber by radiant heat while out of contact with flaming gases.

Compression

Nelson, R. W. RECENT DEVELOPMENTS IN GAS COMPRESSION PLANT FOR DISTRIBUTION SYSTEMS. *Gas J.* (British) *292*, 355-59, 62 (1957) November 13.

Gas distribution in Birmingham at 10-20 psi (10% of total) is achieved to date by reciprocating and centrifugal compressors. The station has been modernized with axial centrifugal compressors. Operating characteristics of the equipment are discussed.

Paul, M. J. UPDATING A PIPELINE SYSTEM. *Petrol. Eng. 29*, D53-56 (1957) November.

Placed in operation in 1930, Natural Gas Pipeline Co. of America's system has been progressively modernized to keep pace with advancing technology. The major modernization programs consist of the following: 1) remotely controlled blowdown systems; 2) modified closed cooling-water systems; 3) supercharging compressor engines; 4) exhaust tuning of auxiliary engines; and 5) exposure of manifold piping.

Condensation

Parker, A. EFFECT OF PRESSURE DISTRIBUTION ON CALORIFIC VALUE OF GAS. *Gas J.* (British) *292*, 345-48 (1957) November 13.

Two methods of estimating the probable reductions in calorific value (measurement of condensate and calculation from the composition of the hydrocarbons), and examples of their applications. It is concluded that with gas of ordinary composition, compression up to 100 lb/sq in. followed by natural cooling in the pressure main is unlikely to lead to the separation of hydrocarbon oils by condensation as to reduce the calorific value by more than 1%.

Cracking Equilibria

Pietsch, H. BERECHNUNG DER GLEICHGEWICHTE BEIM ZERFALL VON AETHAN, PROPAN UND BUTAN (CALCULATION OF EQUILIBRIUM IN THE DECOMPOSITION OF ETHANE, PROPANE AND BUTANE). *Erdol u. Kohle* (German) *10*, 666-69 (1957) October.

The simultaneous equilibria were calculated for the region of 900°-1300° K and 0.5-1.5 atm, neglecting the carbon formation. These concentrations are important for cracking processes and experiments, because they indicate the reaction progress. G. Matus

Dehydration

Veltman, P. V. (assigned to W. R. Grace & Co.) METHOD OF DEHYDRATING GASES. U.S. 2,810,455 (1957) October 22.

A method of dehydrating gases in which the wet gas is contacted with a dehydrating composition, a finely-divided solid desiccant (silica gel). Mineral oil then circulates the desiccant around a drying system, separating the gas.

Distribution Analog

Kayan, C. F. and Balmford, J. A. ANALYSIS OF A PROCESS-FLUID-FLOW NETWORK BY ELECTRICAL ANALOGY. *Trans. Amer. Soc. Mech. Eng 79*, 1957-62 (1957) November.

In a process-fluid-flow network, the determination of the flow distribution by calculation is difficult because of the characteristics of each individual component of the complex. Not only does the pressure drop vary with the pipe dimensions, but also markedly with the flow rate, modified by some exponent. The concept of flow resistance to represent opposition to fluid flow is a useful tool. The pressure drop in any branch may be considered as proportional to the product of the flow rate and the pipeline resistance, and for turbulent flow the resistance is a function of the flow rate. Thus the flow characteristics of a network may be simulated by electrical analogy.

Drilling

Hammer, O. and Sanders, W. M. THE TURBODRILL—A SOLUTION FOR DRILLING PROBLEMS. *Monitor 2*, 4-7, 58-61 (1957) Nov. *Petrol. Week 5*, 28, 30 (1957) Dec. 13.

Dresser Industries' turbodrills have been undergoing a series of field tests designed to evaluate turbodrilling under a variety of conditions. This extensive program includes drilling in "crooked hole" zones and is scheduled to include controlled directional drilling without the use of whipstocks. Data from these field runs clearly show that the proper application of turbodrilling techniques can provide the long awaited breakthrough in drilling economics.

Price, P. H., Tucker, R. C. and Haught, O. RESULTS OF DEEP DRILLING AND FUTURE PROSPECTS IN WEST VIRGINIA. *Prod. Monthly 21*, 42-44 (1957) October.

Most "deep" production in West Virginia to date has been from the Oriskany sands, horizontal and undisturbed in the West, but highly complex and folded in the East. Here many separated fields are known and more are expected. Deeper strata (Silurian, Ordovician and Cambrian) are virtually untested, but three wells showed gas. Discoveries will require intensive drilling and geophysical study.

Eckel, J. E. and Rowley, D. S. HOW ROTARY SPEED AFFECTS PENETRATION RATE. *Oil Gas J. 55*, 86, 87 (1957) November 25.

Penetration rate in drilling increases with rotary speed but not in proportion. The penetration rate curve tends to flatten out at higher speeds, and is more pronounced with carbide-studded bits than with milled-toothed bits.

Paslay, P. R. and Slibar, A. LAMINAR FLOW OF DRILLING MUD DUE TO AXIAL PRESSURE GRADIENT AND EXTERNAL TORQUE. *Petrol Trans. 9*, 310-17 (1957) November.

Using three-dimensional, stress-deformation rate equations for a Bingham plastic, an approximate solution for the laminar flow of drilling mud between the drill pipe and casing is given for the case when the velocity gradients due to axial flow are large compared to velocity gradients due to rotation.

Woods, H. B. and Galle, E. M. HOW WEIGHT AFFECTS PENETRATION RATE. *Oil Gas J. 55*, 88-91 (1957) November 25.

Overall averages of the effect of weight in a number of drilling tests show an approximate straight-line relationship between weight and drilling rate. Within the range of weight investigated, a 50% increase in weight gave a 65% increase in drilling rate.

LP-Gas

Triff, G. TRANSPORTATION ECONOMICS BRING A NEW LOOK IN BULK PLANTS—THE WATER TERMINAL. *LP-Gas 17*, 34-36 (1957) December.

Barging LPG up the Mississippi to Missouri and Illinois has shown sufficient transportation savings so that Simpson Oil Co. has built three water terminals. This is a discussion of the terminal and barge facilities and operations.

GAS LIQUIDS SQUEEZE CRUDE MARKETS. *Petrol. Week 5*, 11, 12 (1957) November 22.

There is a growing demand among Texas producers to prorate gas liquids production to market demand, just as is done now with crude. Output of gas liquids has more than doubled since 1947, to an average of 785,000 bbl/day so far in 1957. Crude production, subject to proration to prevent waste in most major states has only expanded by 42%.

HOW SUN BLENDS BUTANE AUTOMATICALLY. *Pipe Line Ind. 7*, 34-38 (1957) November.

Products are received at four truck unloading positions or 10 tank car stations, transferred to storage, and blended into a 7000-bbl/hour crude stream by remote control. Initial operation of the new system at Sun Oil Co.'s Nederland (Texas) terminal has proved feasible and economical.

Liquefied Gas

Beckwith, S. (assigned to Constock Liquid Methane Corp.) MEANS FOR STORING AND TRANSPORTING COLD LOW-BOILING LIQUIDS. U. S. 2,810,265 (1957) October 22.

A storage means for liquefied low-boiling gas comprising a plurity of gas-tight metal tanks located in a large rigid shell. A thermal insulating material between the outer walls of the tanks and the inner wall of the shell minimizes the heat transfer from the tank to the shell. The gas is maintained at atmospheric pressure and at -258°F temperature.

Lederman, P. B. and Williams, B. ECONOMICS OF GAS LIQUEFACTION. *Gas Age 120*, 41-46 (1957) November 14.

A study of costs and payout possibilities of liquefaction in the shipment and sale of natural gas in the U. S. and overseas markets. The cost of liquefaction is chiefly dependent upon the compressor requirements, while the cost of transportation and storage are functions of distance from source to market and the efficiency with which both tankers and land storage are utilized.

Morrison, W. L. (assigned to Constock Liquid Methane Corp.) METHOD OF LIQUEFYING NATURAL GAS AT CASING HEAD PRESSURE. U.S. 2,811,843 (1957) November 5.

A portion of natural gas is liquefied by expanding it at high pressure thus reducing it to a temperature (-258°F) at which some of the constituents other than methane remain a liquid. This liquid is removed by draining. The resultant gas is then expanded to a much lower pressure, causing some of the methane to be condensed. This stripped gas is cooled and recycled with the initially expanded gas to form a combined stream.

Twomey, L. S. MANIPULATION OF NITROGEN-CONTAMINATED NATURAL GASES. U. S. 2,812,646 (1957) November 12.

Steps of fractionation are given in the preparation of nitrogen-contaminated hydrocarbon gas for pipeline transmission. A nitrogen-enriched vapor and a hydrocarbon-enriched liquid are produced. The stream of this liquid is raised to a high pressure, vaporized and then introduced into a gas transmission line.

Meter Testing

Gehr, W. J. and Prasil, A. G. TESTING AND MAINTENANCE OF LARGE METERS IN THE FIELD. *Gas Age 120*, 15-17 (1957) November 28.

The policies that are followed by a Wisconsin utility regarding field testing and maintenance of large-capacity displacement meters. Operating and maintenance data obtained so far are analyzed.

Pifer, W. G. BELL-PROVING TECHNIQUES. *Gas 33*, 50-54 (1957) December.

Precautions to be taken in using bell-provers. Prover location and levelling, constant temperature, oil for sealing, calibration by bottling, and rates of flow, and the low pressure flow prover (orifice) for large meters.

Neutron Logging

Bailey, B. H., Bryant, H. L. and Powell, N. L. SPOT THOSE GAS ZONES WITH NEUTRON LOGGING. *Oil Gas J. 55*, 368, 70 (1957) November 18.

Creole Petroleum Corp. determines the gas-oil contact by running a gamma-ray neutron log while a well is actually flowing. Results have been encouraging and the method has helped reduce the cost of workovers and well repairs.

Offshore Rig

Calvert, J. W. BIGGEST LETOURNEAU DRILLING BARGE LAUNCHED. *World Petrol. 28*, 82, 83 (1957) November.

The world's largest offshore drilling rig is "Mister Cap," built for Barnwell Offshore Inc., of Shreveport, La. patterned after the standard LeTourneau design. It has overall dimensions of 176 ft 2 in. in length and width and is 151 ft 9 in. in height.

Pipeline Flow

Brigham, W. E., Holstein, E. D. and Huntington, R. L. TWO PHASE CONCURRENT FLOW OF LIQUIDS AND AIR THROUGH INCLINED PIPE. *Pipe Line News 29*, 57-59 (1957) November: HOW UPHILL AND DOWNHILL FLOW AFFECT PRESSURE DROP. *Oil Gas J. 55*, 145, 46, 48, 50, 52 (1957) November 11.

The effect of up and downhill flow on pressure drop was studied. Recent field results show that excessive pressure drops were encountered in two phase pipelines through hilly country. Equipment consisted of clear plastic tubing mounted on an angle-iron frame. Orifice and displacement meters, pressure gages, U-tube manometers, and thermometers were used to measure the flow variables. Experimental results show that stratified flow, which involves a pattern characterized by a change in interfacial height along the length of the pipe, will not exist if there is any irregularity in a pipe such as bend or slight dip. The flow at low rates will be of the slug type.

Elliott, H. A. SUBMARINE PIPELINE REPAIR BELL. U. S. 2,812,641 (1957) November 12.

A submarine pipeline repair bell of simple construction used in a submerged pipeline at the location of a break or defect. It is formed of a pair of shell sections arranged one beneath and one above the submerged pipeline with their open ends in abutting relationship and sealed together.

Long, F. V. SUPERVISORY CONTROL OF GAS PIPELINES. *Petrol. Eng. 29*, D66-70 (1957) November.

The advantages of reduced operating personnel and increased efficiency of the remaining men against the installation cost of control equipment and the additional safety precautions required, with the resulting risk of down time of remotely controlled compressor stations.

Paske, K. UNTERSUCHUNG UEBER DIE WIRTCHAFTLICHKEIT VON GASFERNLEITUNGEN (INVESTIGATION OF THE ECONOMY OF LONG-DISTANCE GAS LINES). 1. *Gas u. Wasserfach* (German) *98*, 1025-37 (1957) October 11; 2. *Ibid.* 1073-80 October 25.

In calculations of long-distance gas lines the goal is to achieve the minimum operation cost with a given hourly rate, length of pipe, pressure ratio, and minimum storage. Details are presented on the building and maintenance cost of long-distance lines as well as total transporting costs. The minimum gas transporting cost is discussed along with pipe transportation cost if loop lines are built. Finally, this information is correlated to transportation of natural gas, with various illustrations and a number of sample calculations which involve the estimation of building and maintenance of long distance pipelines. G. Matus

Pigott, R. J. S. LOSSES IN PIPE AND FITTINGS. *Trans. Amer. Soc. Mech. Eng 79*, 1767-84 (1957) November.

A rational and consistent method of computing velocity head losses in piping, to replace the usual guessing at k, with a range of two or three to one. Contributions of bend losses and roughness losses to the overall loss from previously published experimental studies are critically reviewed and correlated, but modern and more accurate data are needed on these components.

Rippingham, F. R. and White, R. U. 3 YEARS' EXPERIENCE PROVES UNATTENDED

STATION DESIGN. *Pipe Line Ind. 7*, 44-48 (1957) November.

Standard Oil Co. of California's Los Banos station was converted to remote operation after seven years of service. Low maintenance costs and high performance record have confirmed engineers' confidence in its design features. Regular preventive maintenance and a close watch of telemetered data to spot impending trouble have produced a top operating record.

Turner, E. B. AUTOMATION IN FUTURE PIPELINES. *Pipe Line Ind. 7*, 30-33 (1957) November.

The use of completely automatic pipeline systems utilizing computers for control. The computer, which would require both storage and input intelligence, would start-stop units, change set-points and control tanks. It would direct the pipeline operation, changing conditions as required to meet the dispatching schedule.

Reservoir Engineering

Dolan, J. P., Einarsen, C. A. and Hill, G. A. SPECIAL APPLICATIONS OF DRILL-STEM TEST PRESSURE DATA. *J. Petrol Tech. 9*, 18-21 (1957) November.

The following formation characteristics can be determined mathematically from drill-stem test pressure charts: true formation pressures, effective permeability of the entire section tests, well productivities, wellbore damage, and possible detection of barriers. A practical method is presented for immediate determination of effective permeability and wellbore damage from successful double shut-in pressure tests. A list of recommendations for improving the reliability of drill-stem test pressures is also presented.

Dry, I. HERE'S A NOMOGRAPH METHOD OF PREDICTING RESERVOIR PERFORMANCE. *Oil Gas J. 55*, 178-80, 82, 84, 86, 87 (1957) November 11.

This method enables the solution of trial-and-error material balance prediction by use of a set of nomographs constructed for the specific reservoir operating under solution-gas drive, with no initial gas cap, and no water encroachment.

Pirson, S. J. A UNIVERSAL THEORY OF OIL RESERVOIR ENGINEERING. Part 1. *World Oil 145*, 119-24 (1957) September; Part 2. *Ibid.* 209-14 October; Part 3. *Ibid.* 160, 64, 66, 69 November.

Three fundamental and different processes by which oil is recovered from its reservoir rock in the earth are depletion drive, water drive, and segregation and combination drives of production of oil. Unitization, proration, and conservation relationships are discussed.

Tek, M. R., Grove, M. L. and Poettmann, F. H. METHOD FOR PREDICTING THE BACK-PRESSURE BEHAVIOR OF LOW PERMEABILITY NATURAL GAS WELLS. *J. Petrol. Tech. 9*, 302-09 (1957) November.

The general problem of single-phase natural gas flow through porous media has been considered both by mathematical analysis and field experiments. Theoretical studies on the fluid dynamics of natural gas wells resulted in derivations of expressions which permit a better understanding of the flow mechanism for conditions under which Darcy's law is no longer valid. Special emphasis was placed on the study of low permeability, slow stabilizing formations. These applications resulted in a method of predicting the performance coefficients of tight natural gas wells.

Underground Storage

Raymond, L. C. (assigned to Ford, Bacon & Davis, Inc.) CAVERN STORAGE FOR NATURAL GAS. U. S. 2,810,263 (1957) October 22.

A cavern for the storage of gaseous fuels under substantial pressures formed in a rock stratum at least 400 ft below the ground is claimed. Supporting columns are retained to isolate and enclose the cavern from the exploratory boreholes. These facilities permit rapid unloading or discharging of the stored gas during periods of peak demand.

Well Practice

Uren, L. C. PROGRESS IN WELL-COMPLETION METHODS. Part 1. *World Petrol. 28*, 108, 09, 12, 14, 16, 18 (1957) September; SAND CONTROL AND FORMATION OF WELL CAVITIES. Part 2. *Ibid.* 62-64, 66-68 October; INCREASING PERMEABILITY OF FORMATIONS ABOUT PRODUCING WELLS. Part 3. *Ibid.* 106-10, 13, 15 November.

Details of casing, perforating and cleaning

wells are given in Part 1. Part 2 discusses the aids for the exclusion of sand from the producing formation, and for the maintenance and support of well cavities within the reservoir rock. The final article discusses modern well-completion techniques which increase the natural permeability of the reservoir rock about the well by artificial means.

6. PETROLEUM AND SYNTHETIC LIQUID FUELS

Diesel Advances

Chatterton, E. FUTURE DEVELOPMENTS OF THE HIGH-SPEED DIESEL ENGINE. *Trans. Amer. Soc. Mech. Eng. 79,* 1941-56 (1957) November.

Developments offer possibilities for the reduction of size and weight of the diesel engine. The author examines the increased output which results from the combination of a diesel engine and exhaust-driven gas turbine operating with high degrees of supercharge. The limitations and conclusions as to the type of engine best suited to such developments are explained.

Fuel Properties

Rogers, D. T., McDermott, J. P. and Munday, J. C. STATIC ELECTRICITY IN PETROLEUM PRODUCTS. *Oil Gas J. 55,* 166, 68, 72, 74, 77, 79, 81, 85, 88, 90, 92, 95 (1957) November 18.

The production of static electricity in liquid hydrocarbon fuels is associated with the presence of colloidal contaminants which ionize in the hydrocarbon environment. These contaminants are largely organic in nature and come from treating operations.

Geochemical Prospecting

Yost, W. J. THE GEOCHEMISTRY OF URANIUM AND LEAD—AGE-DATING. *Calif. Oil World 50,* 4, 6, 10 (1957) November 15.

The petroleum geologist determines when a particular rock was first deposited, when it was altered, and when it first occurred as he takes cuttings or cores from a well. The most prominent method for determining these times, paleontology, consists of identifying the fossil remains of plants or animals contained within the rock. Other methods depend upon the rate at which various geological processes, such as sedimentation, take place. Radioactivity, also, provides a more accurate and reliable geological clock since certain elements which occur throughout the earth's crust decay radioactively into other elements at fixed rates.

Geology Research

Alexander, C. I. HOW THE A.P.I. IS HELPING TO ANSWER GEOLOGICAL PROBLEMS. *Oil Gas J. 55,* 159-62 (1957) Nov. 18.

The Geological Research Program of the A.P.I. is devoted to answering these questions: 1) what are the source materials of petroleum; 2) how are they converted to gas and oil; 3) what is necessary for their operation; and 4) how important a factor is time.

Hydrocarbon Data

Field, H. W. and Headington, C. E. HOW THE INDUSTRY IS APPLYING KNOWLEDGE GAINED FROM A.P.I. RESEARCH PROJECTS. *Oil Gas J. 55,* 163-65 (1957) November 18.

The projects described include the identification of pure hydrocarbons, knocking characteristics of hydrocarbons, thermodynamics properties of compounds, high molecular-weight hydrocarbons, and sulfur and nitrogen compounds in petroleum.

Sahara Region

Moyal, M. IST DIE SAHARA EIN ZWEITES SAUDISCH-ARABIEN? (IS THE SAHARA A SECOND SAUDI-ARABIA?). *Erdol u. Kohle* (German) *10,* 606-10 (1957) September.

Besides the oil occurrences being developed at Hassi-Massoud and Edjele in Eastern Algeria, there is promise of oil and gas in a number of other Sahara and Mediterranean basins of Algeria.

Sand-Bitumen Separation

Weingaertner, E. ANWENDUNG DER PHASEN-TRENNUNGS-METHODE AUF DIE ENTMINERALISIERUNG VON ATHABASCA-BITUMEN-SAND (THE APPLICATION OF THE PHASE-EXTRACTION-METHOD TO THE DEMINERALIZING OF ATHABASCA-BITUMINOUS-SAND). *Erdol u. Kohle* (German) *10,* 584-87 (1957) September.

Phase extraction methods have been applied earlier to the demineralization of graphite, dewatering of coal-washery sludges (Convertol-

Process) and of peat. This separation principle based on differential wetting of solids was applied to Athabasca bituminous sand which was mixed in a kneader with peat, coal and graphite sludges, and with wetted coal and wood chars. In each case, the organic and inorganic components of the sludges separated, rejoining respectively with the bitumen and sand of the "tar-sand" to form an enriched pasty, viscous or putty phase and a watery, loose-sand phase. Athabasca sand occurs in an area of 30,000 sq miles in North Alberta, Canada and is estimated to contain 15 x 10^6 tons bitumen per sq mile. The actual area has not been completely explored. G. Matus

Shale Oil

Lankford, J. D., Tripp, J. G. and Brakel, L. H. (assigned to U. S. A.) Bould, G. D. (assigned to Calif. Research Corp.) DESTRUCTIVE DISTILLATION OF HYDROCARBONACEOUS MATERIALS. U. S. 2,812,288 (1957) November 5.

The noncondensible hydrocarbon gases from an oil shale retort are preheated in a regenerative pebble heater and recirculated to the shaft-fed, cross-blasted retort as a direct contact heating medium for the raw shale. Oil is condensed from the gas and from retort base, and part of the scrubbed gas is burned to heat pebbles.

Marx, J. W. and Parker, H. W. (assigned to Phillips Petroleum Co.) PROCESS FOR RECOVERY OF PETROLEUM FROM SANDS AND SHALE. U. S. 2,813,583 (1957) November 19.

Steam is injected into one of two boreholes in a hydraulically fractured stratum of low permeability to heat the area to 400° F, and increase the hydrocarbon fluidity. Reduced pressure may be used to further vaporize the water in strata to flush oil to the producing well.

Putman, M. W. (assigned to U. S. A.) DESTRUCTIVE DISTILLATION OF HYDROCARBONACEOUS MATERIALS. U. S. 2,813,823 (1957) November 19.

Sodium chloride, vaporized in the combustion zone, is introduced in the hot gas stream flowing upward through the shale bed, so that none of the small particles of oil condensate will disengage from the gas stream in the cooler shale bed, but will pass out of the retort-top to recovery system.

van Dijck, W. J. D. (assigned to Shell Development Co.) METHOD AND APPARATUS FOR RECOVERING SHALE OIL FROM OIL SHALE. U. S. 2,814,587 (1957) November 26.

In a shaft-type retort, recovery of shale oil is improved by heat recovery from the combustion of spent shale using indirect heat exchange with product vapor fractions to preheat and convert the shale.

THE FUTURE OF OIL SHALES. *Petrol.* (British) *20,* 443-45 (1957) December.

Proved reserves of shale oil are much greater than those of crude oil in the U. S. and from it high-quality light crude oils can be produced. However, the problems of extracting the oil from the rock and its transportation do not as yet permit large-scale or economic exploitation. Two retorting processes are described and transportation problems reviewed in connection with the Colorado Valley development.

World Data

Lenzen, T. L. INTERNATIONAL ASPECTS OF PETROLEUM INDUSTRY. *Drilling 19,* 71-73 (1957) November.

The U. S. has long been aware of its dependence upon oil, but it is only in the last few years that Western Europe has recognized a parallel. Data are given of the world oil reserves, consumption and crude production.

White, R. E. CONTRACTING GOES GLOBAL. *Drilling 19,* 81-85 (1957) November.

Data are presented on the free world petroleum supply. U. S. petroleum requirements in 1966 will be approximately 14.3 million bbl daily and free foreign requirements will be approximately 14.2 million bbl daily.

7. ANALYTICAL METHODS AND TESTS

Adsorption Analysis

Constantinides, G. and Arich, G. LIMITAZIONI DEL METODO WATSON PER L'ANALISI DEGLI ESTRATTI AROMATICI (LIMITATIONS OF THE WATSON METHOD FOR DETERMINING AROMATICS IN EXTRACTS). *Riv. Combust.* (Italian) *11,* 568-78 (1957) September.

This method gives well repeatable results, provided care is taken to perform elution at 20°C,

and an adsorbent with suitable characteristics employed. If the diameter of the pores is too small, with products having a higher molecular weight, the paraffin-aromatic separation will be quite insufficient.

Holmes, J. M. and Beebe, R. A. ADSORPTION STUDIES ON A SERIES OF HEAT TREATED SHAWINIGAN ACETYLENE CARBON BLACKS. *Canad. J. Chem. 35,* 1542-54 (1957) December.

A study of the adsorption of N_2, SO_2, CO_2 and NH_4 on Shawinigan acetylene carbon black and several derivatives of this material produced by heat treatment up 3000°C.

Hutchins, J. W. (assigned to Phillips Petroleum Co.) GAS ANALYSIS. U. S. 2,813,010 (1957) November 12.

A method of analyzing the hydrocarbon constituents of gas streams based upon the selective adsorption properties of silica gel, activated charcoal, etc. The improvement lies in the continuous or periodical withdrawal of a portion of the adsorbent material from the zone through which the gas stream is passed. Less time and gas are needed to saturate the remaining adsorbent with the heavier hydrocarbons which are present in smaller quantities than are the lighter hydrocarbons.

Air Pollutants

Strange, J. P. POTENTIOMETRIC RECORDER FOR HYDROGEN SULFIDE AND HYDROGEN CYANIDE. *Anal. Chem. 29,* 1878-81 (1957) December.

An instrument has been developed for continuous potentiometric determination of hydrogen sulfide or hydrogen cyanide in air or plant process streams. Gas is removed by an alkaline liquid absorbent and determined in a potentiometric cell containing a vibrating silver electrode and a saturated calomel reference. Range can be adjusted from 4 ppb to 50 ppm or more.

Thomas, J. F., Tebbens, B. D., Mukai, M. and Sanborn, E. N. DETERMINATION OF AROMATIC HYDROCARBONS IN POLLUTED AIR. *Anal. Chem. 29,* 1835-40 (1957) December.

Techniques have been developed for separation of fluorescent organic material found in polluted aerosol samples. Particulate organic compounds are separated into three broad classes by conventional techniques involving solubility. Each group is separated into pure components by paper strip chromatography or electrophoresis. Identification is made by measuring ultraviolet absorption and fluorescent spectra.

CO_2 Measurement

Stott, F. D. SONIC GAS ANALYZER FOR MEASUREMENT OF CO_2 IN EXPIRED AIR. *Rev. Sci. Instruments 28,* 914, 15 (1957) November.

A sonic gas analyzer intended primarily for estimation of CO_2 in the physiological range of 0-10% is described. The instrument uses a resonant cavity maintained in oscillation by a transistor amplifier as the measuring device; the change in frequency caused by the presence of CO_2 in the cavity is linearly related to the amount of CO_2 present. As described the instrument is intended for continuous sampling at a rate of about 2 1/min. The time response is about 0.5 sec for full deflection.

Toren, P. E. and Heinrich, B. J. DETERMINATION OF CARBON DIOXIDE IN GAS STREAMS. *Anal. Chem. 29,* 1854-56 (1957) December.

Carbon dioxide in range from 1 ppm to 100% in a gas stream can be found by passing gas through a saturated solution of an alkaline earth carbonate containing excess solid, and measuring pH. At equilibrium, pH of solution is determined by carbon dioxide content of gas phase. Method is precise to within ±5% of carbon dioxide content.

Coke Analysis

Hindin, S. G., Lee, J. K. and Weller, S. W. CARBON-HYDROGEN ANALYSIS OF COKE ON CATALYSTS. *Anal. Chem. 29,* 1850-52 (1957) December.

A new combustion method for determination of carbon and hydrogen in coke on cracking catalysts is much superior in determination of hydrogen, as it is independent of water present in catalyst. Hydrogen is determined by measuring volume of oxygen required for oxidation to water.

Electron Microscopy

Carls, W. H. ELECTRON MICROSCOPE AS AN ANALYTICAL TOOL. *Refining Eng. 29,* C20-22 (1957) November.

The effect of fuel oil additive is determined clearly and decisively with the aid of the electron microscope.

Halide Tracers

Schultz, H. A. MEASUREMENT OF CONCENTRATIONS OF GASEOUS HALIDE TRACERS IN AIR BY POSITIVE ION EMISSION TECHNIQUES. *Anal. Chem. 29,* 1840-42 (1957) December.

Dichlorodifluoromethane, Freon 12, is a promising tracer for study of stack effluents in the atmosphere. It is an odorless, colorless gas, noncorrosive and nontoxic in required concentrations. Gas can be measured in air in concentrations as low as 0.1 ppm by special techniques involving use of a modified halogen leak detector.

Naphthalene Methods

Hofman, P. UEBER EINE NEUARTIGE APPARATUR ZUR BESTIMMUNG VON NAPHTHALIN IN GASEN (A NEW APPARATUS FOR THE DETERMINATION OF NAPHTHALENE IN GASES). *Gas u. Wasserfach* (German) *98,* 1081-83 (1957) October 25.

This apparatus for the determination of naphthalene is advantageous in comparison to the two best known so far (Zwieg and Kissendey, and Seebaum and Krecke). It features the use of only one Dewar-container, a special wash bottle with exchangeable parts and ground glass. The wash bottle necessary for removal of NH_3 is combined in one special housing which also holds the Dewar bottle. The ease of handling and stability make it a useful tool for process control. G. Matus

Kane, L. J., Gentile, J. J., Trostle, K. E., Katell, S. and Shale, C. C. TURBIDIMETRIC DETERMINATION OF NAPHTHALENE IN GAS. U. S. Bur. Mines Rep. Invest. 5368 (1957) October.

A turbidimetric determination is used on a suspension of naphthalene picrate to determine naphthalene in gas. Saturate picric acid at 3°-4°C is used as reagent and optical density can be read on any type of calibrated turbidimetry device although a spectrophotometer is preferred.

Mott, R. A. and Moulson, I. THE DETERMINATION OF NAPHTHALENE IN TOWN GAS BY THE PICRATE METHOD. Part 1. THE DISSOCIATION OF NAPHTHALENE PICRATE. Part 2. THE INDENE CORRECTION. Part 3. MISCELLANEOUS OBSERVATIONS. *J. Appl. Chem.* (British) *7,* 546-62 (1957) October.

The reaction constant, and its temperature-dependence, of the reaction naphthalene + picric acid ⇆ naphthalene picrate has been determined and shown to account for the losses of naphthalene from air containing naphthalene in known concentrations when bubbled through picric acid. This enables a correction to be applied to determinations at 10°-18°C. Determination of picrates formed by the unsaturated hydrocarbons such as indene on an aliquot of the recovered picrates is enhanced by the use of total recovered picrates with acetone as the solvent and bromothymol blue as the indicator in the titration with Wij's solution. The wash-bottles are immersed in a thermostatically-controlled bath and a correction applied for the loss due to dissociation of naphthalene picrate.

Nitrogen

Belcher, R., West, T. S. and Williams, M. SUBMICRO-METHODS FOR THE ANALYSIS OF ORGANIC COMPOUNDS. Part 1. THE DETERMINATION OF NITROGEN. *J. Chem. Soc.* (British), 4323-28 (1957) October.

Nitrogen in organic compounds is determined by decomposing a sample about 0.05 mg, in a sealed tube and titrating the ammonia thus formed with a standard solution of sodium hypochlorite. The results are comparable in accuracy with those obtained on the microscale.

Shale Tar

Eizen, O. G. and Arro, I. Kh. COMPOSITION OF INTERMEDIATE GAS GENERATOR TAR PRODUCED FROM ESTONIAN SHALE. *Khim. i Tekh. Topliva i Masel* (Russian), 39-43 (1957) No. 11.

Dephenolized, vacuum distilled fractions of shale tar were analyzed by chromatographic separation followed by spectrographic identification. Composition is given in terms of paraffins and naphthenes, unsaturates, aromatics, and oxygenated compounds. The following were identified: fluorene, anthracene,

phenanthrene, 2-methyl-anthracene, pyrene, and benzo-β-naphthol-2-3-α-furan.

J. W. Penney

Trace Metals in Crudes

Witherspoon, P. A. and Nagashima, K. USE OF TRACE METALS TO IDENTIFY ILLINOIS CRUDE OILS, Circular 239. Urbana: Illinois State Geological Survey, 1957.

Trace metals were determined by spectrochemical methods in crude oils from eight Illinois fields. Trace metal concentrations of a particular oil may be sufficiently different from those of closely associated oils that the vanadium and nickel contents can be used as a positive means of identification.

Water Spectra

Palmer, C. H. Jr. LONG PATH WATER VAPOR SPECTRA WITH PRESSURE BROADENING. Part 1. 20μ to 31.7μ. Part 2. 29μ to 40μ. *J. Optical Soc. Amer. 47,* 1024-31 (1957) November.

Transmission spectra for the region 20μ to 3.17μ at a resolution of about 4 cm^{-1}. The water vapor partial pressure ranges from 0.02 — 0.07 cm Hg and the nitrogen partial from 0 — 60 cm Hg and the nitrogen partial pressure from 0 — 60 cm Hg. The method for sample analysis is indicated and the importance of adsorption effects demonstrated. Regions are reported from 29μ to 40μ with a resolution of 5 cm^{-1}.

8. GENERAL AND PHYSICAL CHEMISTRY

Atomic Gas Reactions

Ford, H. W. and Endow, N. RATE CONSTANTS AT LOW CONCENTRATIONS. Part 3. ATOMIC OXYGEN REACTIONS IN THE PHOTOLYSIS OF NITROGEN DIOXIDE AT 3660 A. *J. Chem. Phys. 27,* 1156-60 (1957) November.

Quantum yields at concentrations below 4 x 10^{-7} mole/l in nitrogen at one atmosphere pressure. The effects of small amounts of added nitric oxide and oxygen on the quantum yields were also observed. From these data and an assumed mechanism it was possible to calculate the rates of reaction of atomic oxygen with NO and nitrogen relative to the rate of reaction of atomic oxygen with molecular oxygen.

Kistiakowsky, G. B. and Volpi, G. G. REACTIONS OF NITROGEN ATOMS. Part 1. OXYGEN AND OXIDES OF NITROGEN. *J. Chem. Phys. 27,* 1141-49 (1957) November.

Several reactions of nitrogen atoms have been investigated in a low-pressure flow system, using the principle of a "stirred reactor" and a mass spectrometer for the determination of steady-state concentrations. The elementary processes which have been definitely demonstrated to occur and their rate constants are given.

Carbon Properties

Gel'd, P. V. MECHANISM OF THE REDUCTION OF OXIDES WITH SOLID CARBON. *Uspekhi Khimii* (Russian) *26,* 1070-86 (1957) No. 9.

The role of the gaseous phase (pressure, flow rate of the inert gas, components of the gaseous reaction products), low-temperature reduction, and diffusion processes in the oxide lattices (general nature of the process, nature of the diffusing particles, rate of the diffusion stages, energy of activation) are surveyed.

Assoc. Tech. Services, Inc.

Kessler, F. M. and Vecerikova, V. ROENTGENOMETRISCHE STUDIE DES GRAPHITIERUNGSVORGANGES (X-RAY STUDIES OF THE PROCESS OF GRAPHITIZATION). *Brennstoff-Chemie* (German) *38,* 297-305 (1957) October 16.

A new method is outlined for interpreting the diffraction diagrams. These distinguish quantitatively the various products according to the degree of graphitization, crystallization, and by a shaping factor. The correlation between the properties of the raw materials and the individual products is derived on the basis of the dependence of the changes in the structure of graphitization time and temperature.

G. Matus

Porter, G. HIGH-TEMPERATURE CHEMISTRY. *Endeavour* (British) *16,* 224-29 (1957) October.

Reactions at high temperatures present many points of both theoretical and practical importance. Reactions at temperatures up to 5000° C are discussed, above which, at ordinary pressures, molecular species disappear and matter consists almost wholly of atoms and ions. Latent heat of sublimation of carbon, a physical constant of great importance, is described.

S.C.I. CONFERENCE ON INDUSTRIAL CARBON AND GRAPHITE. *Chem. Ind.* (British) *No. 44,* 1442-47 (1957) November 2.

Delegates from 12 nations presented 66 papers at the conference of the Society of Chem. Industry on "Industrial Carbon and Graphite" at London University. Six sessions included papers on physical properties, manufacture, crystal structure, surface properties, electrical behavior, nuclear power uses, and mechanical, chemical and metallurgical applications. Publication is expected early next year.

Catalysts

Burwell, R. L. Jr. STEREOCHEMISTRY AND HETEROGENEOUS CATALYSIS. *Chem Reviews 57,* 895-934 (1957) October.

Aspects of stereochemistry and heterogeneous catalysis of potential interest in the development of the understanding of the mechanisms of heterogeneous catalytic reactions. Hydrogenation, reduction reactions and relationships to optical activity are discussed.

Louw, J. D., Van Den Berg, J. P., Ferreira, L. C. and Pienaar, J. J. APPEARANCE OF FeC IN A HYDROCARBON SYNTHESIS CATALYST. *J. Amer. Chem. Soc. 79,* 5899-906 (1957) November 20.

The normal equilibrium catalyst in a type of Fischer-Tropsch synthesis reactor contains Haegg iron carbide as a significant component. A new crystalline phase was discovered in the Debye-Scherrer X-ray diffraction diagram. A deposit from the wall of the reactor was found to consist mainly of this new phase and this material was studied by X-ray diffraction and wet chemical analysis. The diffraction pattern showed this phase to be FeC, and wet chemical analyses support the conclusion.

Maxted, E. B. and Biggs, M. S. THE CATALYTIC TOXICITY OF NITROGEN COMPOUNDS. Part 1. TOXICITY OF AMMONIA AND OF AMINES. *J. Chem. Soc.* (British), 3844-47 (1957) September.

The toxicity of ammonia towards platinum in the catalytic hydrogenation of cyclohexene, and the suppression of this toxicity of small concentrations of water. This toxicity has been compared with that of the cyanide ion, which forms a convenient standard for poisons containing nitrogen. The toxicity of some typical saturated amines, and the detoxication of these amines by acetic acid were also studied.

Sabatka, J. A. and Selwood, P. W. THE STRUCTURE OF NICKEL-COPPER-SILICA CATALYSTS. *J. Phys. Chem. 61,* 1564-67 (1957) November.

Specific magnetizations are given for several nickel-copper-silica catalyst samples from -196°-600°C, after reduction, and both before and after sintering. The degree to which true solid solution of nickel and copper occurs in these systems is found to depend on the overall nickel concentration. Samples containing high concentrations of nickel tend to yield more nearly homogeneous solution.

Wortman, R., Gomer, R. and Lundy, R. ADSORPTION AND DIFFUSION OF HYDROGEN ON NICKEL. *J. Chem. Phys. 27,* 1099-1107 (1957) November.

With a technique previously used on W, it has been found that diffusion occurs with an activation energy of 7 ± 1 kg-cal in the chemisorbed layer, without the precipitation boundaries observed on W. A field dependent transformation in the adsorbed film was found between 2°-4°K. and interpreted as a shift in the equilibrium between adsorbed H_2 molecules and the terminal fraction of adsorbed H atoms. The implications of this result for the mechanism of H_2-D_2 exchange are discussed.

EXTENSION OF CLITHEROE CATALYST PLANT. *Chem. Ind.* (British) *No. 43,* 1411, 12 (1957) October 26.

The operation of Britain's only plant devoted exclusively to catalyst manufacture is discussed. The production process, carried out in one building, is divided into three separate units: the ferrous bearing, the nonferrous bearing, and the Victor Oxide catalyst-producing units, each of which must be kept completely separate. The manufacture of the oxide catalysts takes places in the following process sections: 1) pasting section for unit processing; 2) oven section for drying, decomposition, calcination, etc.; and 3) pelleting section for dry processing.

Chemisorption

Kisliuk, P. THE STICKING PROBABILITIES OF GASES CHEMISORBED ON THE SURFACES OF SOLIDS. *J. Phys. Chem. Solids 3,* 95-101 (1957) No. 1/2.

A theory of the sticking probability is presented which differs from those in the literature in that the rates of migration and desorption for physisorbed molecules when they are above sites occupied by chemisorbed molecules are not assumed to be equal to these rates when they are above unoccupied sites for chemisorption.

Lee, E. L., Sabatka, J. A. and Selwood, P. W. THE MECHANISM OF CHEMISORPTION: HYDROGEN ON NICKEL. Part II. *J. Amer. Chem. Soc. 79,* 5391-97 (1957) October 20.

Further work has been done on the magnetic changes which occur when hydrogen is chemisorbed on a nickel-silica catalyst. It has been shown that no simple relation exists between surface bond type and magnetic change, as observed in a variety of samples. The thermal transients which are observed on admission of hydrogen have been used to obtain the differential heat of adsorption. Hydrogen adsorbed on these samples at room temperature gives a small positive, rather than a negative, change of magnetization if the magnetization is measured at liquid hydrogen temperature.

Scholten, J. J. F. and Zwietering, P. KINETICS OF THE CHEMISORPTION OF NITROGEN ON AMMONIA—SYNTHESIS CATALYSTS. *Trans. Faraday Soc.* (British) *53,* 1363-70 (1957) October.

The rate of chemisorption of nitrogen on iron catalysts is proportional to the pressure. This article considers newly developed views on nitrogen chemisorption and gives a short summary of some new experimental data recently obtained.

Compressibility

Pfennig, H. W. and McKetta, J. J. COMPRESSIBILITY FACTORS AT LOW PRESSURES. *Petrol. Refiner 36,* 309-12 (1957) November.

Experimental data for ethylene, propylene and butene-1 up to two atmospheres pressure.

Heat Capacities

Halford, J. O. and Miller, G. A. STANDARD HEAT CAPACITIES OF GASEOUS METHANOL, ETHANOL, METHANE AND ETHANE AT 279°K BY THERMAL CONDUCTIVITY. *J. Phys. Chem. 61,* 1536-39 (1957) November.

Limiting low-pressure gaseous heat capacities are measured with a band-wire type thermal conductivity cell and a Knudsen pressure gage. The spectroscopic heat capacities of nitrogen and methane and the accurately known heat capacity of ethane are reproduced at 279°K. The Knudsen gage provides some extension of the scope of the thermal conductivity heat capacity method to compounds of higher molecular weight and lower volatility and yields measurements which should be substantially independent of adsorption and gas imperfection errors.

Infrared Spectra

Plyer, E. K. and Blaine, R. B. INFRARED EMISSION SPECTRUM OF METHANE AT 3.3 MICRONS. *J. Research 59,* 317, 18 (1957) November.

The emission spectrum of methane from the flame of a Bunsen burner has been observed in the region from 2,820-3,180 cm^{-1}. Many lines have been measured in the P-, Q-, and R-branches. The spectrum was observed from the inner cone of the flame and with a rich fuel mixture the P-12 line was most intense. This intensity distribution indicated a temperature of about 1,200° K for the heated gas.

Permeable Membranes

Rogers, C. E., Stannett, V. and Szwarch, M. PERMEABILITY OF GASES AND VAPORS THROUGH COMPOSITE MEMBRANES. PERMEABILITY VALVES. *Ind. Eng. Chem. 49,* 1333-36 (1957) November.

Systems exhibiting different permeabilities for different flow directions may be used as "valves" in special applications. Such systems are described and the conditions required for their operation are discussed. Permeability of gases and vapors and the rate of gas transmission are measured through composite membranes which are composed of layers of different polymer films. Theoretical transmission through two films in series was calculated from the experimental data.

Thermal Conductivity

Powell, R. L., Rogers, W. M. and Coffin, D. O. AN APPARATUS FOR MEASUREMENT OF

THERMAL CONDUCTIVITY OF SOLIDS AT LOW TEMPERATURES. *J. Research 59,* 349-55 (1957) November.

A description of an apparatus used for determining the thermal conductivities of solids in the temperature range of 4°-300°K. The apparatus is especially suited to the determination of thermal conductivity over a large temperature interval, enabling coverage of the temperatures between the normal boiling points of liquefied gases. Illustrative results are given for an insulator, polytetrafluoroethylene, and for a high-conductivity commercial coalesced copper. The methods of data analysis and estimation of errors are given.

Thermal Diffusion

Lonsdale, H. K. and Mason, E. A. THERMAL DIFFUSION AND THE APPROACH TO THE STEADY STATE IN H_2-CO_2 AND He-CO_2. *J. Phys. Chem. 61,* 1544-51 (1957) November.

Apparatus for measuring both the steady state and the rate of approach to the steady state by radioactive tracers. Saturation ionization currents are used to follow the progress of the thermal diffusion. The results are in agreement with those obtained by previous methods. Intermolecular forces are calculated and agree with forces calculated from semi-empirical combination rules.

Heines, T. S., Larson, O. A. and Martin, J. J. SEPARATION OF BENZENE AND n-HEPTANE IN CONTINUOUS THERMAL DIFFUSION COLUMNS. *Ind. Eng. Chem. 49,* 1911-20 (1957) November.

The effects of column height, spacing, feed rate, temperature gradient, and feed composition on the separation of two liquids in a continuous thermal diffusion column. The results provide design parameters which may be used tc determine the dimensions and operating conditions of a continuous thermal diffusion column to accomplish some desired separation.

Thompson, C. J., Coleman, H. J., Ward, C. C. and Rall, H. T. SEPARATION OF ORGANIC SULFUR COMPOUNDS BY LIQUID THERMAL DIFFUSION. *Anal. Chem. 29,* 1601-11 (1957) November.

Liquid thermal diffusion is an effective method for separation of many classes of sulfur compounds. Separations can be achieved in many instances on materials with identical boiling points and/or molecular weights. Continuous withdrawal of sample from extreme ends of column is superior to batch operation. Excellent separations are given by a semimicro-column.

Water Irradiation

Firestone, R. F. THE RADIATION CHEMISTRY OF WATER VAPOR. THE INDIRECT EFFECT ON DEUTERIUM AND THE EXCHANGE OF D-ATOMS WITH WATER MOLECULES. *J. Amer. Chem. Soc. 79,* 5563-98 (1957) November 5.

The tritium β-ray induced exchange between deuterium gas and water vapor containing tritium-water has been studied to measure the radical-pair and water decomposition yields in irradiated water vapor. A value for the radical-pair yield of 11.7 $\pm$ 0.6 radical pairs/100 e.v. has been determined. The exchange takes place via a chain mechanism above 150° C.

Water Treatment

Helwig, J. D. and McConomy, H. F. HOW 31 REFINERIES CONDITION COOLING-WATER SYSTEMS. *Oil Gas J. 55,* 101, 03-06 (1957) December 2.

Fouling and corrosion occur in all refinery cooling-water systems when treatment is not practiced. Cost of adequate treating methods are in the order of $1 to $5 per day per 1,000 gpm of water circulated and can be justified.

9. ORGANIC CHEMISTRY AND PETROCHEMICAL

Acetylene

Hachmuth, K. H. (assigned to Phillips Petroleum Co.) METHOD AND APPARATUS FOR THE REMOVAL OF ACETYLENE FROM GASES CONTAINING ETHYLENE. U. S. 2,809,710 (1957) October 15.

In the recovery of acetylene from a mixture of product gases by dissolving in acetone, a process is claimed for removing the small amounts of ethylene and ethane dissolved in the "rich" acetone. A third component is added such as pentane, which forms an intermediate boiling azeotrope with the acetylene and acetone at a temperature sufficiently low to strip out as gas the undesirable components.

Lehrer, E. and Buschmann, K. (assigned to Badische Anilin & Soda-Fabrik, Germany) PRODUCTION OF ACETYLENE BY INCOMPLETE COMBUSTION OF HYDROCARBONS. U.S. 2,812,374 (1957) November 5.

A process for the production of acetylene by incomplete combustion of hydrocarbons is claimed in which the mixing chamber for the preheated hydrocarbon-air input is formed of a Cr-Si-Al-Fe alloy for more rapid heat transfer on quenching.

Pearce, F. G. (assigned to Pan American Petroleum Corp.) PROCESS FOR MANUFACTURE OF ACETYLENE. U.S. 2,813,919 (1957) November 19.

In a two-vessel regenerative cracking process for producing acetylene from lower hydrocarbons, the product gases after recovery of acetylene are reacted with oxygen to reheat the cracking zone, producing a useful synthesis gas.

Canadian Chemicals

CARBIDE'S STAKE IN PETROCHEMICALS. *Canad. Chem. Processing 41,* 55-57 (1957) November.

Union Carbide Canada's latest producing division officially opens its Montreal East petrochemical plant. The plant processes waste gas from three neighboring refineries. Ethylene is extracted and purified. The raw gas is thermally "cracked" in pressure vessels to give additional ethylene, propane, propylene and hydrocarbons used for fuel. Acetylene, also separated, is piped to Linde Air Products. Sulfide-bearing acid gases will be piped by Carbide to Laurentide Chemicals.

Adcock, W. A. and Lake, W. C. (assigned to Pan American Petroleum Corp.) PROCESS FOR PREPARATION OF CARBONYL SULFIDE AND CARBON DISULFIDE. U. S. 2,809,097 (1957) October 8.

A mixture of methane, sulfur and oxidizing gas (O_2,CO_2) is reacted at conditions of carbon deposition comprising pressures of 1-40 atm, temperatures of 525°-925° C, S/H ratios of 0.2-1.0, and C/S ratios of 0.2-1.2, to yield carbon disulfide and carbonyl sulfide. H_2S and sulfur may be recovered from product outlet and recycled.

Ethylene Production

Cobb, J. R. Jr. (assigned to Phillips Petroleum Co.) PRODUCTION OF ETHYLENE. U.S. 2,813,920 (1957) November 19.

Ethylene of 99.9% purity is produced from high-ethylene (95-98%) bottoms cut from an "ethylene splitter." The splitter operates on overhead fraction from a de-ethanizer, splitting out an overhead of 10-30% of the ethylene fed to flush out the methane.

Hogan, R. J. and Gardner, L. E. (assigned to Phillips Petroleum Co.) TWO-STEP PROCESS FOR THE SELECTIVE REMOVAL OF ACETYLENE FROM OLEFIN AND/OR DIOLEFIN CONTAINING HYDROCARBON STREAMS. U. S. 2,814,653 (1957) November 26.

Acetylene impurities are selectively removed from a stream of olefin and diolefin hydrocarbons by an improved catalytic process, comprising a low-temperature (to 500°F) hydrogenation step and a subsequent high-temperature (to 700°F) hydrogenation-polymerization step with a reduced alkalized iron oxide-chromium oxide catalyst.

Petrochemicals

Adams, D. A. W. INDUSTRIAL ORGANIC INTERMEDIATES: PAST, PRESENT AND FUTURE. *Chem Ind.* (British) *No. 44,* 1428-33 (1957) November 2.

Changes in the industrial aromatic field in Britain and the U. S. include 1) broadening of usage in which plastics, fibers, and detergents take more than dyestuffs 2) increased uses of petroleum as source, and 3) increased complexity of intermediates. Changes and production data for sulfonates, phenols, halogen, nitro and amino intermediates are summarized.

Hixon, F. E. SOLVENTS FROM PETROLEUM. *Petrol.* (British) *20,* 448-50, 56 (1957) December.

Originally, the only outlet for waste gases from petroleum refineries was as fuel for boilers, furnaces or occasionally as domestic fuel in local towns, but most of the gas was burnt at a flare. Now butane is used as a raw material in the manufacture of rubber, and propane is the starting point of several solvents, most important of which is acetone. The processes avail-

able for its manufacture by catalytic and non-catalytic methods are described.

1957 PETROCHEMICAL HANDBOOK. *Petrol. Refiner 36*, 193-304 (1957) November.

Petrochemical production will pass the 40 billion-pound level in 1957—more than 3% over 1956. This year's production will be valued in excess of $4.75 billion, an increase of 4% over 1956. Ten short articles presented by authors from separate large manufacturing companies give digests on principal products. A 98-page section gives flow sheets and description of 145 processes for various chemicals and 13 separation processes.

PETROCHEMS OPEN NEW WEST TEXAS ERA. *Petrol Week 5*, 33-36 (1957) November 1.

A butadiene plant and a synthetic rubber plant have been completed in West Texas, and a styrene plant and refinery are under construction. The new petrochemical complex—styrene-butadiene-synthetic rubber—is the nation's first privately-financed and completely integrated synthetic rubber operation.

PETROCHEMS TO EXPAND ON GULF COAST. *Petrol. Week 5*, 36, 38 (1957) November 29.

In 1957, petrochemical production was 38-billion lbs, about 26% of total chemicals produced. Virgin raw materials—natural gas, LPG, and natural gasoline—will continue in ample supply in 1965. The economics of these materials, however, are not as bright as supply. Natural gas now supplies about 50% of the raw materials for petrochemicals. Average prices have increased from about 6¢ to 10¢ per MCF. Total byproduct hydrogen from Gulf Coast reformers should be about 433 MMCF/day by 1965.

SHUT DOWN MAJOR CHEMICAL, SYNTHETIC GASOLINE PLANT. *Chem. Eng. Progress 53*, 50, 52, 54, 56, 80 (1957) October.

Amoco Chemicals will close down its Brownsville, Texas, unit (first opened in 1950 by Carthage Hydrocol, Inc.) where synthetic gasoline and chemicals were produced from natural gas. While the process proved technically possible, it could not produce gasoline and chemicals from natural gas as cheaply as other processes.

10. CHEMICAL ENGINEERING

CO_2-NH_3 Separation

Buck, A. and Cramer, C. (assigned to Inventa A. G. fuer Forschung und Patentverwertung, Switzerland) PROCESS FOR THE SEPARATION OF CARBON DIOXIDE AND AMMONIA. U. S. 2,808,125 (1957) October 1.

A process for the separation of a gaseous mixture of NH_3 and CO_2 claims the use of 45-60% ammonium nitrate solution at 9-11 atm and 135-150°C to selectively absorb NH_3. After CO_2 is bled from the top of the absorber, the pressure is reduced by passing the solution into a desorber at one atm and 85°C whereupon NH_3 of 97% purity is released.

Computation

Ball, W. E. and Johnson, R. C. FOR MATERIAL BALANCES AND HEAT TRANSFER: HOW TO SET UP THE NECESSARY MATHEMATICS. *Chem. Eng. 64*, 284, 86, 88, 90, 92, 94 (1957) September; ANALOGIES IN PHYSICAL SYSTEMS HELP TO DEVELOP BASIC EQUATIONS. *Ibid.* 296, 98, 300, 02, 04 October.

In a series designed to assist the chemical engineer, the first installment gives the basic equations for material balances and heat transfer. The second part concern analogies between mechanical, electrical and chemical systems, showing derivation of equations of performance from input and output factors.

Cooling Towers

Fuller, A. L., Kohl, A. L. and Butcher, E. A NEW PLASTIC PACKING FOR COOLING TOWERS. *Chem. Eng. Progress 53*, 501-05 (1957) October.

A new plastic tower packing, developed for use in water cooling towers, is claimed to be well suited as a gas or vapor-liquid contact medium in other applications because of high mass-transfer coefficient, low pressure-drop characteristics, and relatively inert chemical structure.

Dust Collectors

Samfield, M. DUST-COLLECTING EQUIPMENT. *Cost Eng. 2*, 106-09 (1957) October.

Factors influencing the selection of the proper dust collecting equipment are dust loading, volume of gas handled, range of particle sizes, degree of collection desired, and nature of the

operating conditions. Operating and maintenance costs of specific dust-collecting equipment are included.

Fluid Flow

Miller, B. EVEN FOR REYNOLDS NUMBER IN THE MILLIONS, EQUATION GIVES FRICTION FACTOR. *Chem. Eng. 64*, 253, 54 (1957) December.
Additional data verify validity of linear relation between friction factors and high Reynolds numbers for fluid flow through pipelines.

Fractionation

Jones, R. A. and Milton, R. M. (assigned to Union Carbide Corp.) ARGON PURIFICATION. U. S. 2,810,454 (1957) October 22.
The separation of cold argon-oxygen mixture obtained from the rectification of liquid air is accomplished by using a molecular sieve as an adsorbent. The mixture is passed through the adsorbent which removes substantially all of the oxygen but passes the argon. This separation can be effected with insignificant increase in the temperature of the elements in the mixture.

Locklair, E. E. and Portzer, H. J. (assigned to Union Carbide Corp.) PROCESS AND APPARATUS FOR SEPARATING GAS MIXTURES. U. S. 2,812,645 (1957) November 12.
A method and apparatus for fractionating air in a low-pressure air separation cycle. Gaseous oxygen in a state of substantial purity is produced with high oxygen recovery and reduced power requirement.

Heat Transfer

Bras, G. H. P. SIMULTANEOUS HEAT AND MASS TRANSFER. *Chem. & Proc. Eng.* (British) *38*, 427-29, 31 (1957) November.
A graphical method for the calculation of the interface conditions in case of simultaneous heat and mass transfer. The method can be used for the design of tubular cooler condensers and direct gas-liquid contact equipment, e.g. water heaters, gas saturators, gas coolers, driers, etc.

Paschkis, V. and Hlinka, J. W. RATE OF TEMPERATURE CHANGE OF SIMPLE SHAPES. *Trans. Amer. Soc. Mech. Eng. 79*, 1742-51 (1957) November.
Charts show rates of temperature change in simple shapes plotted against temperature. Additional curves show time values, so that one graph yields any of the three relationships; rate-temperature, rate-time, temperature-time. Samples of the charts are shown, examples of use are given, and limits of the graphs are tabulated. Methods used in establishing the charts are given.

Buehl, R. C. DESIGN OF PYROMETALLURGICAL PILOT PLANTS. *J. Metals 9*, 1359-62 (1957) October.
Pyrometallurgical pilot plants usually suffer from excessive heat loss because of the large surface area. Scale factors should not be applied to the thickness of the refractory. If too much insulation is applied, rapid refractory erosion slows thermal equilibrium and vitiates results. For operations over a narrow range of temperatures, correction for heat loss can usually be applied to pilot plant data. When heat production is related to the normal reactions, it is desirable in pilot plant research to alter certain operations, raw materials, or temperatures to produce extra heat.

Philbrook, W. O. FUNDAMENTALS OF SCALE MODEL EXPERIMENTS. *J. Metals 9*, 1353-62 (1957) October.
Reduced scale model and pilot plant experiments are based on the principles of similarity, which require that dimensionless parameters descriptive of the limiting physical and chemical processes must be the same for both model and full-size equipment. In the usual practical case, a careful analysis must be made to learn which natural laws are the most critical and which may be neglected or corrected. Such studies can be potent tools toward understanding our complex and gigantic metallurgical processes.

Liquid-Liquid Contact

Leva, M. and Wen, C. Y. LIQUID-LIQUID FLOW IN PACKED TOWERS. *Chem. Eng. 64*, 267-71 (1957) December.
Correlations on flow data that pertain to liquid-liquid contacting in gravity-operated packed towers.

Packless Pumps

Klima, B. B. PACKLESS PUMPS. *Cost Eng 2*, 88-105 (1957) October.
Packless pumps are used where fluids must be moved without contamination or loss. Cost data on the three basic types, seal-less centrifugal, diaphragm, and peristaltic, are presented.

11. PROCESS EQUIPMENT AND INSTRUMENTATION

Abrasive Cleaning

LeBlanc, W. P. METER CLEANING BY "ROTOBLAST." *Amer. Gas J. 184,* 20-22 (1957) November.

The Rotoblast, used by United Gas Corp's Houston division, uses centrifugal force to spray a selected size of steel grit upon objects that need cleaning. Abrasive material fed in a rapidly rotating, vaned wheel is thrown by intense centrifugal force at the target meters and regulators taken out of service for reconditioning.

Ceramic Kiln Design

THE "HEART" OF CERAMIC MANUFACTURING PROCESSES. *Ceramics* (British) *9,* 14-19 (1957) November.

Kiln design is one of the most important parts of modern ceramic manufacturing processes. The design must incorportate equipment for the generation and use of controlled atmospheres. The atmosphere used may vary from an extremely strong reducing atmosphere (100% H_2) to a more mildly reducing atmosphere (those produced by cracking of gases).

Computers

Burnett, E. THE MARKET FOR COMPUTERS IN THE OIL AND NATURAL GAS INDUSTRY. *Computers & Automation 6,* 10, 12-14 (1957) November.

The oil industry will rent (probably not buy) digital computers and data processors over the next five years valued (at sale price) at about $525 million. In the largest 40 companies computer products worth $500,000 will be rented for each 1000 persons employed.

Ezekiel, F. D. and Paynter, H. M. COMPUTER REPRESENTATIONS OF ENGINEERING SYSTEMS INVOLVING FLUID TRANSIENTS. *Trans. Amer. Soc. Mech. Eng 79,* 1840-50 (1957) November.

This paper deals with the applications of modern analog and digital computing machines to engineering solutions of the fluid-transient problems. Methods are described for computer representations of various physical elements commonly used in hydraulic and pneumatic systems such as conduits, valves, pumps, etc.

Kolflat, T. and Knapp, K. E. HOW TO USE DIGITAL COMPUTERS TO CALCULATE PIPING FLEXIBILITY. Part 1. *Heatg. Pipg. and Air Condg. 29,* 106-08 (1957) October; Part 2. *Ibid.* 124-27 November.

The physical factors affecting piping flexibility in central station piping systems and how recent trends have amplified these factors are outlined in the first article. The second article discusses what flexibility calculations determine, and describe the computer procedure using an adaptation of the general analytical method.

Concrete Lance

POWDER-LANCING CLEARS WAY FOR GENERAL ELECTRIC RADIATION LAB. *Ind. Science Eng. 4,* 27 (1957) November.

In powder-lancing, a mixture of iron and aluminum powder is fed pneumatically into a lance handle and mixed with oxygen. The powder and oxygen are mixed in the lance handle, carried to the cut by the pipe, and produce a bombardment of burning iron and aluminum particles which melts the concrete. Cuts in concrete 12 ft thick have been made with the lance, but theoretically there is no limit to the depth of the powder lance's cut. Using Linde's powder lance, the concrete walls are being cut into 20 x 16 ft sections which weigh up to 18 tons apiece. Cutting speed is about 1-1/2 ft/hr.

Control by Radiation

RADIATION FOR PETROLEUM PROCESSING PLANTS. *Petrol. Week 5,* 97-126 (1957) November 15.

Fourteen big refiners are now saving millions of dollars a year by using nuclear energy as a tool to improve plant operations. Radioisotopes have an edge as the source of radiation in the plant, but accelerators lead in the lab. Radiation should expand rapidly in process control and maintenance although the next few years will tell whether the cost barrier can be overcome. Scores of applications in tracing and gauging have now proved feasible and are in everyday usage.

High Pressure Optics

Fitch, R. A., Slykhouse, T. E. and Drickamer, H. G. APPARATUS FOR OPTICAL STUDIES TO VERY HIGH PRESSURES. *J. Optical Soc. Amer. 47,* 1015-17 (1957) November.

An apparatus has been developed in two stages

which permits optical studies to 200,000 atm pressure. The use of NaCl windows permits studies in the near ultraviolet and in the infrared as well as in the visible. A calibration tested against Bridgman's data to 87,000 atm is given.

Pipeline Cleaner

Leith, M. L. Jr. ELECTROMAGNETIC PIPELINE CLEAN-OUT MEANS. U.S. 2,812,921 (1957) November 12.

A structure for carrying associated cleaning devices is claimed which is moveable within the pipeline by an attracting electromagnet on a rolling platform located outside the pipeline.

Pyrometry

Benarie, M. M. OPTICAL PYROMETRY BELOW RED HEAT. *J. Optical Soc. Amer. 47,* 1005-09 (1957) November.

Optical pyrometry is extended to the temperature range of 400°-500°C, by using a dark adapted eye as the photometric comparison instrument. It is demonstrated experimentally and theoretically that in this range of temperature the accuracy of the scotopic optical pyrometry is not lower than that of pyrometry at higher temperatures where photopic vision is used.

Gill, T. P. SOME PROBLEMS IN LOW TEMPERATURE PYROMETRY. *J. Optical Soc. Amer. 47,* 1000-05 (1957) November.

Some of the problems arising in low-temperature pyrometry are considered, with special reference to the measurement of small temperature differences. The influence of changes in emissivity and the general spectral distribution of the energy exchange between two bodies at nearly the same temperature are discussed, and curves are given which are considered to be useful in the practical application of low-temperature pyrometry.

Standards Testing

Kidwell, W. M. EQUIPMENT FOR A STANDARDS LAB. *Instruments & Automation 30,* 2066-72 (1957) November.

A list of equipment, philosophy of test, and calibration schedule for a reference standards laboratory of a large manufacturer of precision equipments. Included are instruments purchased for a primary and a secondary standards laboratory for calibration of voltage, current, resistance, capacitance, inductance, power, temperature, weights, and measures, pressure and vacuum, length, acoustics, flow and vibration. Total cost, excluding secondary instruments, was below $50,000.

Storage Equipment

Duffy, E. PLAYA DEL REY. UNDERGROUND GAS STORAGE. *Instruments & Automation 30,* 2080-82 (1957) November

On the combined systems of the Southern California, Southern Counties and Pacific Lighting Gas Supply companies there are four underground storage projects presently in operation. Playa del Rey is relatively small, with a capacity of about 1500 MMCF. Centered in the Southern California market area, it is an ideally located underground holder from which to meet the hourly and daily peak demands. The modernization program included a new and larger compressor building and office. The withdrawal capacity was doubled and provided for increases up to 27 MMCF an hour by the winter of 1961-62. The injection rate can be boosted to 150 MMCF with the addition of three more compressors.

12. MATERIALS OF CONSTRUCTION, AND CORROSION

Cathodic Protection

Haycock, E. W. CURRENT REQUIREMENT FOR CATHODIC PROTECTION OF OIL WELL CASING. *Corrosion 13,* 767t-74 (1957) November.

Methods used to indicate the minimum applied current required to give complete cathodic protection are discussed and evaluated in terms of their scientific basis and their applicability to the protection of oil well casing. The results of these experiments lead to a modification of the log current—potential criterion of complete protection widely used at the present time.

Coatings

Brown, N. L. DEVELOPMENT AND APPLICATION OF HIGH DENSITY ASPHALT MASTIC COATING. *Gas Age 120,* 37, 40-42 (1957) November 28.

An adequate protective and weight coating for pipeline laid in marsh, swamp and offshore has proven satisfactory under test and field conditions.

Miley, N. E. PLASTIC TAPE PAYS OFF FOR A-L ON LARGE-DIAMETER PIPE LAYING. *Gas Age 120,* 48-52 (1957) November 14.

In November, 1956, the Amer. Louisiana Pipe Line Co. completed the construction of a 22-in. tie-line, from Ohio to Michigan. Part of this line, 122 miles, was the first large-diameter line to be completely protected by the use of plastic tape. This is a report on the application of plastic tape materials and the application, together with protective outerwrap, for large diameter pipe.

NACA Tech. Com. T-2D, METHODS FOR MEASURING LEAKAGE CONDUCTANCE OF COATING ON BURIED OR SUBMERGED PIPELINES. *Corrosion 13,* 803t-05 (1957) December.

The different techniques of measurement required on long and short pipeline sections are defined. In the basic method, the interrupted current is drained, and the changes in total current flow and potential with respect to the remote earth are determined. The average leakage conductance is then calculated.

Oechsle, S. J. Jr. and LeFevre, K. G. SURFACE PREPARATION FOR PROTECTIVE LININGS AND COATINGS USED IN CRITICAL SERVICE. *Eng. Digest 18,* 485, 86, 514 (1957) November.

Three primary causes of coating failure are loss of adhesion, osmotic blistering, and under-film corrosion from the presence of foreign matter, such as mill scale, dirt, grease, oil and chemical deposits. In any surface preparation, the desirable goal is a white metal surface. A paint or coating system is intended to exclude detrimental products from the surface of the base material.

Corrosion

Fontana, M. G. CORROSION AND ITS MANIFESTATIONS. *Chem. Eng. Progress 53,* 525-30 (1957) November.

An introduction to the various types of corrosion including pitting, uniform corrosion, dezincification, etc. Methods for combatting corrosion are illustrated and classified into the following eight categories: alloying, cathodic protection, metallic and inorganic coatings, organic coatings, metal purification, alteration of the environment, nonmetallic materials and design.

Halbig, J. CORROSION. PROBLEM-SOLVING METHODS AND MATERIALS. *Chem. Eng. Progress 53,* 520-24 (1957) November.

In a general treatment of the question of corrosion in chemical engineering experience, the author outlines a sound engineering approach toward effective investigation procedures, practical corrective measures, and points out some common pitfalls to avoid when undertaking corrosion investigations.

Hume, J. S. CORROSION OF OIL-INDUSTRY STORAGE TANKS. *Oil Gas J. 55,* 153, 54, 56, 58, 60 (1957) November 11.

The results of a survey conducted by the A.P.I. on tank corrosion are presented in the first section. The second section is a selected bibliography of tank-corrosion articles and abstracts of these articles.

NACE Task Group T-1C-5, STATUS OF DOWNHOLE CORROSION IN THE EAST TEXAS FIELD. *Corrosion 13,* 743t-46 (1957) November.

A report is made on a questionnaire survey on the status of downhole corrosion in the East Texas field. Corrosion in East Texas is felt to vary from mild to severe depending on water production and well location. It was agreed that downhole corrosion presented a problem that could be combatted. Data presented indicated that well maintenance cost could be reduced 60-90% using commercial inhibitors.

Young, W. E. and Hershey, A. E. A THERMOCHEMICAL STUDY OF SOME ADDITIVES TO REDUCE RESIDUAL FUEL ASH CORROSION. *Corrosion 13,* 725t-32 (1957) November.

Based on the premise that liquid fuel-ash components are associated with the attack on refractory alloys, a theoretical study has been made of mixtures of vanadium pentoxide and sodium sulfate with various metallic oxides and sulfates. The thermal stabilities of the sulfates were investigated. It is concluded that the sulfate would be the stable form, particularly at gas-turbine operating pressures. The additive with the most promise was an aluminum compound.

Inhibitors

Jenny, R. ORGANIC CORROSION INHIBITORS FOR IRON *Ind. Finishing* (British) *9*, 872, 74-76, 90 (1957) October.

Organic inhibitors of the mercaptan type were tested at the French Petroleum Institute. For strong HCl, iron was protected best by the primary mercaptans. The latter always reacted with the iron, leaving an iron sulfide deposit. Detailed studies of the reaction, the breakdown and the mechanism are discussed.

Johnson, E. E. and Francis, H. A. OXIDATION INHIBITOR. U. S. 2,807,592 (1957) September 24.

A combined oxidation and corrosion inhibitor for 1 to 5 C-atom mercaptan odorants is claimed which consists of 0.001 — 0.1% of guaiacol and from 0.001 — 0.1% of secondary amines.

Rowe, L. C. AN EVALUATION OF INHIBITORS FOR CORROSION PREVENTION IN AN ENGINE COOLING SYSTEM. *Corrosion 13*, 750t-56 (1957) November.

The diverse characteristics of coolants used in a multi-metal engine cooling system are discussed along with their relationship to the selection of laboratory test methods to investigate inhibition. The effectiveness of inhibitors, such as sodium borate, is compared by using rotating specimen type of test. The metals investigated are steel, copper, brass, aluminum, cast iron, and solder. Results are based on corrosion rate, microscopic examination, pit depth when applicable, and other examinations.

PVC Piping

Kelleher, J. P. and Mantell, C. L. HOW TO WORK RIGID PVC PLASTIC PIPING. *Chem. Eng. 64*, 300, 02, 04, 08 (1957) December.

Engineering techniques for machining, bending, installing and repairing rigid polyvinyl chloride plastic piping.

13. NEW BOOKS

Air Pollution

Faith, W. L. Renzetti, N. A. and Rogers, L. H. AUTOMOBILE EXHAUST AND SMOG FORMATION. California: Air Pollution Foundation Report No. 21, 1957.

The Los Angeles' photochemical type of smog will be eliminated only after adequate methods of controlling automobile exhaust emissions are adopted. Methods to control hydrocarbon emissions fall into three classes: 1) devices that modify engine operating conditions; 2) devices that treat exhaust gases; and 3) use of modified or alternate fuels. This report summarizes the work done and obstacles that still hinder an effective solution as background data for scientists and engineers unfamiliar with the details.

Applied Mathematics

Mickley, H. S., Sherwood, T. K. and Reed, C. E. APPLIED MATHEMATICS IN CHEMICAL ENGINEERING. New York: McGraw-Hill Book Co., Inc., 1957.

A consolidation of the advanced methods of mathematics for the student and the professional engineer. Emphasis is focused on the engineering application of mathematics. Considerable attention is given to expressing a physical situation in a mathematical language. The material covered falls into three broad categories: 1) the treatment and interpretation of engineering, 2) the analysis of situations involving only one independent variable, and 3) the analysis of situations involving two or more independent variables. The text material begins with a discussion of the process of differentiation, and the development of more advanced procedures follows in a step-by-step manner.

Hydrocarbon Phase Relations

Eilerts, C. K. et. al., PHASE RELATIONS OF GAS-CONDENSATE FLUIDS. TEST RESULTS, APPARATUS, AND TECHNIQUES. VOL. 1. (U.S. Bur. Mines Monograph 10) New York: Amer. Gas Assoc. 1957.

The results of a study of properties of natural hydrocarbon mixtures that are pertinent to the recovery of gas and natural-gas liquids from underground reservoirs. A cooperative effort by the A.G.A. and the Bureau of Mines, continued since 1934. The volume contains chapters dealing with compositions, properties and cricondenbar pressures of separator gas and liquid and of two-component and multicomponent mixtures, and phase diagrams of eight gas-condensate fluids. Correlations of experimental data of the Bureau of Mines and complementary data available in the literature and descriptions of equipment and techniques will be presented in Volume II.

Bibliographies and Literature Searches

The library will prepare bibliographies and make literature searches on a cost basis plus a service charge. A comprehensive statement detailing the problem must be presented with the request.

Photocopies

Photostatic or microfilm copies of articles abstracted in *Gas Abstracts* are available at cost.

Abstracts on Cards

Copies of all abstracts in *Gas Abstracts* are available on 5 x 8 cards; information on this service will be furnished on request.

Russian Translations

English translations of Russian articles abstracted herein can be supplied by arrangement with the abstractor.

Periodicals Abstracted for GAS ABSTRACTS

Air Conditioning, Heating and Ventilating
Air Pollution Association, Journal
American Chemical Society, Journal
American Gas Association Monthly
American Gas Journal
American Institute of Chemical Engineers, Journal
American Petroleum Institute Quarterly
American Society for Testing Materials Bulletin
American Society of Mechanical Engineers. Transactions
Analytical Chemistry
Appliance Manufacturer
Association for Computing Machinery, Journal
Australian Journal of Applied Science
Australian Journal of Chemistry

Bituminous Coal Research Reports
Brennstoff-Chemie
British Coal Utilization Research Association Monthly Bulletin and Quarterly Gazette
Butane-Propane News

California Oil World
Canadian Chemical Processing
Canadian Gas Journal
Canadian Journal of Chemistry
Canadian Journal of Physics
Canadian Journal of Technology
Chemical and Engineering News
Chemical and Process Engineering
Chemical Engineering
Chemical Engineering Costs Quarterly
Chemical Engineering Progress
Chemical Engineering Science
Chemical Processing
Chemical Reviews
Chemical Society (London) Journal
Chemical Week
Chemistry and Industry
Coal Heat
Coke and Gas
Combustion
Combustion and Flame
Computers and Automation
Construction Methods and Equipment
Corrosion
Corrosion Technology

Drilling

Engineers' Digest
Erdöl und Kohle

Faraday Society. Transactions
Fuel
Fuel Efficiency
Fueloil and Oil Heat

Gas
Gas Age
Gas and Oil Power
Gas Council (British) Publications
Gas Heat
Gas Journal
Gas Times
Gas und Wasserfach
Gas World

Heating, Piping and Air Conditioning

Independent Petroleum Association of America Monthly
Industrial and Engineering Chemistry
Industrial Finishing
Industrial Gas (American)
Industrial Gas (British)
Industrial Heating
Institute of Fuel (British). Journal
Institute of Gas Technology Publications
Institute of Petroleum (British). Journal
Institution of Gas Engineers. Bulletins, Communications and Transactions
Instruments

Jet Propulsion
Journal des Usines a Gaz
Journal of Applied Chemistry
Journal of Applied Mechanics
Journal of Applied Physics
Journal of Chemical Physics
Journal of Metals
Journal of Organic Chemistry
Journal of Petroleum Technology
Journal of Physical Chemistry
Journal of Research (National Bureau of Standards)
Journal of Scientific Instruments

Laboratory Practice
LP-Gas
Lubrication

Materials and Methods
Mathematical Aids
Mechanical Engineering
Metal Progress
Mining Engineering

National Advisory Committee for Aeronautics, Reports
National Fire Protection Association Quarterly
National Gas Bulletin of Australia
National Petroleum News
Nuclear Science and Engineering
Nucleonics

Official Gazette of the U.S. Patent Office
Oil and Gas Journal

Petroleum
Petroleum Engineer
Petroleum Processing
Petroleum Refiner
Physics and Chemistry of Solids
Physics Today
Pipe Line Industry
Power
Producers Monthly
Public Utilities Fortnightly

Radiation Applications
Refrigerating Engineering
Review of Scientific Instruments
Revue Generale du Gaz
Rivista dei Combustibili

Science
Svenska Gasverksföreningens Månadsblad
U.S. Bureau of Mines, Bulletins, Information Circulars, Reports of Investigations and Technical Papers
World Oil
World Petroleum

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